Gas Journal

MARCH 4, 1936

Vol. 213 88th Year No. 3798

Editorial Notes

Castle Bromwich, 1936

THE much discussed return of the Gas Industry to the British Industries Fair has been made, and many will now be taking stock of the situation after the Castle Bromwich fortnight. Whatever thoughts there may be on the subject, one fact seems to have been quite universally agreed—that it was the finest show by far which our Industry has put up in all the years of its participation. Towards this achievement the Fair authorities had undoubtedly made their contribution, and the general lay-out of the Section, the wider gangways and so forth, gave far more scope to the display craft which has been so keenly developed by our manufacturers. Viewing the gas exhibit as a whole—its bulk and its general attractiveness—it was impossible not to reflect upon how much the return of the prodigal must have meant to the Fair as a whole, and, since it is usually accepted that the Fair is of importance to British Industry, we may justly claim that gas has once again " done its bit " from motives that were anything but self-seeking.

At the same time, while the published figures of " foreign buyers " can give us little of the direct thrill which exhibitors in general can obtain from them, there is undoubtedly a feeling of satisfaction in participating in this fine display by British Industry of which we are such an integral part, just as there was an undefinable sensation of missing something when we were absent last year, which we believe was attributable to more than the mere breaking of what had become a habit. The difficulty, as we have often pointed out before, is in arriving at any equitable distribution over all sections of the Industry of the cost of the effort, since it is idle to pretend that there is any possibility of such direct return in orders booked as will recoup to any material extent a gas exhibitor's expenses, while the value of " prestige " advertising is not assessable.

In these circumstances, it was gratifying to discover a more general spirit of willing co-operation than in some previous years, which had its effect on the tone of the whole event, and must have given great gratification to those who had shouldered the heavy responsibilities of organization, and those who hold the view that it is essential for the Gas Industry to participate. We have already mentioned that the lay-out of the Section was such as to give unusual encouragement to exhibitors, but we suggest that there were other factors of greater influence. We are happy, in fact, to believe that the spirit which inspired them was a further manifestation of the determination of the manufacturers to pull their full weight in the British Gas Federation, and to make of it a prestige organization such as the Industry has never had and badly needs. It will be remembered, of course, that the whole effort was sponsored by the Federation, which has only come into being since the last official participation by the Gas Industry.

Another factor making for general satisfaction was the " hub " which was formed by the Central Information Bureau and its neighbour, the really excellent Industrial Exhibit. The demonstrations, for example, of the South Metropolitan and Gibbons Bros. glass furnace were a constant source of entertainment to large crowds, from the centre of one of which, incidentally, we heard the somewhat naive enquiry, " Is that a real fire or is it electricity?" Fortunately, the right answer was quickly forthcoming, that it was indeed a very real fire.

Though perhaps the most important, we have left till last a reference to the support given on this occasion by gas undertakings in the attendance, in larger numbers than ever before, of their personnel. In fact, so successful were the efforts of the Joint Gas Conference Committee in respect of attendance numbers that they were faced with applications for tickets for the two luncheons exceeding by over 150 each the available seating accommodation, large as it was. While praising the efforts and the excellent work of the Committee, as well as Lord Dudley's Address and Mr. Dean Chandler's Paper, we do not regard the visits of undertakings' representatives otherwise than as the least they can do to support those who bear the brunt of the affair. And yet even numbers carry embarrassment when they are concentrated into so few days. To the gas exhibitor one gas manager equals, shall we say, at least one hundred " foreign buyers," and we heard laments from some of the stands where it was impossible to give the attention which would have been desired to so many important callers all at once. The Joint Conference idea is the best so far devised for gathering up the clans, but, in order to render the maximum assistance to the exhibitors, it is still worth further thought whether some other system giving better spread-over is feasible. It has even been suggested that the district associations might shoulder the responsibility of getting their members to Castle Bromwich on different days, but, whether the present system is continued or not, the essential is that numbers shall continue to increase.

We have referred to the splendid work of those who

organized the Section and the Conference, but it would not be fitting to close this note without special reference to the help which was so gladly given, whenever asked, by the Birmingham Gas Department, and particularly in person by Mr. A. W. Smith and Mr. W. L. S. Spinks. Again and again we heard mentioned with gratitude both the big and the little ways in which they had oiled the wheels.

Gas in Industry

THE Paper given by Mr. Dean Chandler, of the South Metropolitan Gas Company, at the Joint Conference exemplifies in an arresting manner many of the remarkable developments in recent years which have placed gas in such a favourable position as a fuel for industry and commerce; and it is to be hoped that efforts will be made to ensure that, through the medium of their specialized trade journals, manufacturers and industrialists will be given opportunity of realizing how well equipped our Industry is to help in solving their manufacturing problems. The telling photographs, together with brief description, of modern gas heating units which constitute a considerable section of Mr. Chandler's contribution surely provide good " copy " for many trade journals beyond those covering the activities of the Gas Industry.

Mr. Chandler's Paper glimpses the enormous possibilities of gas as a fuel in industry and commerce, but the Author rightly emphasizes that only by a more enlightened appreciation of the essential requirements of present-day conditions will these possibilities be translated into actualities. We can legitimately be proud of the industrial progress of gas during the past few years, but this gratification must not be allowed to cloud the horizon of a vastly extended sphere of action in a competitive field. We need more men trained to understand the various processes in which gas is, or can be, applied as fuel, and we need to foster still greater co-operation between supplier and user of gaseous fuel. In this regard the Gas Development Centres have already performed a service of incalculable worth. Again, as a result of their work, there is now a far greater measure of co-operation among the various units of our Industry. " The Gas Industry," observes Mr. Chandler, " has, or can design, the right appliances and is rapidly getting the right gas prices, and it therefore remains to see that they are so introduced to the manufacturing community that both the Gas Industry and the manufacturers obtain the full advantage." It is important that in the expression " Gas Industry " Mr. Chandler does not distinguish between gas supply undertakings and gas appliance makers. The interests of these two complementary sections are so obviously closely identified that differences of outlook are now rapidly disappearing and the spirit of co-operation is steadily becoming more vigorous.

Precise automatic control of temperature and furnace atmosphere are the chief features which have led to the pre-eminence of gas as an industrial fuel, and in perfecting these two features the undertakings forming the centres of the Gas Development Scheme have, as is well known, been largely responsible; and, as was to be expected, Mr. Chandler refers to the researches into furnace atmosphere control undertaken with such a successful outcome by the Sheffield Gas Company. The larger undertakings which head the Centres have the necessary financial and technical resources to develop industrial business and carry out the necessary research. The results of this work are available not merely to the members of the individual Centres, but to all Centres. There is, in fact, country-wide exchange of experience. And Mr. Chandler remarks that the Central Office—the co-ordinating organization—by virtue of its standing is in a position to treat with similar bodies throughout the world, and the latest developments and knowledge could thereby be made available to the smallest participating undertaking. Where no specialized knowledge is available, or any commercial application of such knowledge, the Centres can apportion among themselves the carrying-out of the necessary experiment, so that one undertaking alone does not have to bear the entire burden of its cost.

Work of the Centres

WE emphasize this more particularly in view of Mr. Chandler's suggestion that the time has come for the Industry to support yet another trade publication—a publication devoted to the use of gas in industry. After all, he says, the salesmen, as distinct from the works and distribution engineers, have their own journal; and he feels that the industrial gas salesman, a specialist section of increasing numbers and importance, would find of considerable assistance a paper devoted to their own branch. As an example of the type of paper he has in mind, he quotes the American periodical, *Industrial Gas*, with which many of our readers will be familiar. Such a publication would, he thinks, become a valuable reference book on an extensive range of trades, and would help the ordinary salesman to appreciate the enormous possibilities of gas in industry and commerce. It would also form a useful link with our customers. It is interesting, however, to contemplate how such a publication would, with the organization of Development Centres already in being, help *vitally* in the gaining of new industrial gas business. Of necessity such a Paper would have to be extremely well informed—if it is to be of real use, better informed, in fact, than the Central Office of the Gas Development Scheme, which is the clearing house for all the vast amount of information gained by each and every centre. As things stand at present, a member undertaking of the Scheme, if up against a particular problem—it may be new; it may already have been solved—applies to the appropriate Centre, and thus in reality to all the Centres, for information and help. Every day this information grows in volume and range, and is the accumulated, pooled experience of industrial gas problems right up to the date of enquiry. For obvious reasons, this information is confidential and would not be available to a publication such as Mr. Chandler envisages. In such circumstances it is very difficult indeed to appreciate how the proposed paper would greatly help to develop new business; and in saying this we have in mind also the excellently prepared publications of the British Commercial Gas Association dealing with industrial processes to which gas is applied and which are specifically designed to appeal to the manufacturer and industrialist.

It is not as though the existing Technical Press of the Gas Industry were indifferent to the publication of information on the development of the uses of gas in industry and commerce. The reverse is, in fact, true. In our own case, the " JOURNAL " has consistently given full publication of such developments, for our belief in the industrial and commercial possibilities for gas is by no means a new one. Reference to files of the " JOURNAL " shows what a great deal of space has been allotted to, and what an amount of care has been exercised in, the presentation of technical information and news concerning the applications of gas to industrial processes. One may cite as examples the account in the " JOURNAL " for Feb. 19 last of the research on the bright annealing of non-ferrous metals carried out by the Sheffield Gas Com-

pany, and the Paper by Messrs. Dieterichs and Lloyd in to-day's "JOURNAL" on the subject of the application of gas to vitreous enamelling. Also, throughout its existence—now extending over several years—the "GAS SALESMAN" has been the reverse of indifferent to the uses of gas in industry. We are not using this as a line of argument against Mr. Chandler's request for another gas paper. Our point in these comments is that we find it difficult to visualize an enormous growth in the industrial sales of gas brought about by such a publication unless it was better informed than the Industrial Develop- present working of the Scheme.

Gas Increases

THE results of provincial gas companies published in recent issues of the "JOURNAL" provide, we think, grounds for satisfaction and point to larger increases during the present year. Assessing these results it is necessary to bear in mind that a small percentage increase may involve the sale of a huge quantity of gaseous energy. Turning to the results of the London companies, these are by no means what one could wish, yet the Gas Light and Coke Company's gain of 1·1% in 1935 represents a matter of 515 million cu.ft., equal to 75 million units of electricity—and there are few suppliers of electricity in the Company's vast area which reached that total for their whole annual output. Our point is that percentages should be regarded in relation to the quantity of sales involved—a point apt to be ignored by our competitors. The tale which municipal undertakings will have to tell after the end of the financial year this month should be more encouraging than the story of the companies, for they will have the advantage of—from the gas viewpoint—a favourable winter. Increases during the past three months by all gas undertakings are far and away above "normal."

Many provincial gas companies have, however, quite startling records to show for the year ended Dec. 31 last. The Sheffield Company is among the outstanding examples with an increase of over 11%. This represents 660 million cu.ft., considerably more than the total sales of towns such as Hastings or Carlisle. And as the Company sold an additional bulk supply, the total increase amounted to over 16%, or 966 million cu.ft. The Newcastle-upon-Tyne and Gateshead Gas Company reports a gain of nearly 7%, and this again represents a very large volume of sales. Then we have Barnet with an 8% increase, York with 7·3%, Watford with 6·4%. We have mentioned that local authorities, able to take into account the severe winter months, should have a good showing. As a matter of fact, one undertaking has already completed its financial year; in last week's "JOURNAL" we recorded an increase by the Chesterfield Gas Department of no less than 15%. As we have said, the amount of energy implied by such increases is enormous. If this is the swan song of the Gas Industry it is indeed an extraordinary one and can give little pleasure to the ears of the electricians.

Coke Research

IT is now ten years since the formation of the Midland Coke Research Committee, which is financed by grants from the producers and users of blast furnace coke in the Midland area, supplemented by a grant from the Department of Scientific and Industrial Research administered by the Industrial Research Council of the British Iron and Steel Federation. The work of the Committee has provided a very good example of the advantages accruing from collaboration between maker and user in research. Already the investigations have gone a long way in enabling the properties of coke most suitable for the user to be determined, and, on the other hand, in assisting the maker to produce economically the cokes having the desirable properties for specifie purposes. The properties of coke in regard to its use in blast furnaces and for other metallurgical applications have been the main concern, but the use of coke for domestic purposes is now receiving a good deal of attention. This is brought out in the Committee's Report of Progress during 1935.

The experimental work of the Committee consists of "field" investigations at coke oven and blast furnace plants and of laboratory investigations in the Department of Fuel Technology of Sheffield University. Oven tests aiming at improved coke quality include such problems as the effect of fineness of grinding on blends of coal, the addition of coke dust, tar, and pitch to slacks, and the influence of durain. Laboratory work includes studies of coke formation, combustion of coke, methods of testing abradability of coke, and sampling and analysis. The work is of much value to the Gas Industry, and an extract from the Committee's Report will be found on a later page.

Electricity Supply (Meters) Bill

THE Electricity Supply (Meters) Bill was read for a second time in the House of Commons last week. The purpose of this Bill is to overcome the difficulty created by the decision of the Court of Appeal in the case of Joseph *v.* the East Ham Corporation. In this case, which was before the Court of Appeal in July last, the East Ham Corporation, being the electricity supply undertakers for the area, cut off the supply of electricity to a Mr. Harold Joseph on the ground that he had not paid the amount due for his electricity. Mr. Joseph contended that the supply had not been given through a duly certified meter, in that his meter had not been certified by an electric inspector.

Mr. Joseph relied upon certain sections of the Electric Lighting Acts, which had in the past been more honoured in the breach than in the observance. These sections provide that the amount of energy supplied shall, unless otherwise agreed between a consumer and the undertaker, be ascertained by means of an appropriate meter duly certified, and that the meter shall be considered duly certified if it has been certified by an electric inspector. No electric inspectors have been appointed, and therefore no electricity meter can be regarded as duly certified.

It was held, therefore, by the Court of Appeal that Mr. Joseph was not liable to pay for his electricity. The case certainly created a difficulty for the electricity industry, and in order to overcome this difficulty the Bill has been introduced by Mr. Herbert Williams, M.P. It provides that the Electricity Commissioners shall appoint competent and impartial persons to be meter examiners, and such meter examiners shall discharge the duties which should, under the Electricity Acts, have been discharged by an electric inspector. The Bill, however, provides that any meter which is installed before July 1, 1937, shall be deemed, until it is disconnected and removed, to be, and always to have been, an appropriate meter duly certified.

No doubt the case of Joseph *v.* the East Ham Corporation has created an intolerable situation which should be remedied by Parliament. At the same time, a Bill which provides that meters which have not been duly certified in the past shall be deemed to have been duly certified will no doubt be closely examined by the Committee of the whole House to which it has been consigned. In any

event, a householder might with justification view with rather more doubt the record of his electricity meter than that of his gas meter, which will, of course, have been duly stamped in compliance with the Gas Meter Regulations, 1920.

Reliability

LAST week's "JOURNAL" recorded a serious electricity breakdown which occurred at Bradford early on the evening of Feb. 24, as a result of an explosion at the Corporation electricity works. The explosion was followed by fire, and we learn from our local correspondent that before the night was out damage to the electricity works was done estimated at anything from £50,000 to £100,000. Only a comparatively small part of the city had its electricity supply renewed the morning after the fire. By evening of that day the electricity output was about half the normal, but it was days before power was available for industrial purposes, and many thousands of factory operatives were thrown out of work for the early part of the week. It is not expected that the electricity station will be entirely back to normal for many weeks.

The breakdown naturally caused much confusion and great inconvenience, and once again the reliability of gas stood out in sharp contrast to the vagaries of electricity. Those wholly dependent on electricity must have had their enthusiasm somewhat damped and have cast envious eyes at the steady illumination of the gas lighted streets and the steady comfort of the gas equipped homes of their neighbours. The reliability of gas was brought home to the citizens of Bradford, and it is not surprising that this enforced realization resulted in excellent business for the Gas Department, which worked overtime to cope with the demand for gas appliances and the re-connecting of gas points in different classes of property.

Citizens in Arms

WE hear much nowadays about the keenness of the competition by which the Gas Industry is assailed—so much, indeed, that we cannot avoid a feeling of sympathy with a London electricity company who are being accused of dilatoriness in taking up such weapons of offence as may lie ready to their hands. A Special Correspondent of a leading London evening newspaper has "revealed" that the Kensington Branch of the National Citizens' Union are behind a movement to press the Kensington Borough Council to demand at once that the Ministry of Transport should inquire particularly into allegations that the Notting Hill Electric Lighting Company, Ltd., "have not provided an adequate two-part tariff, that they do not offer sufficient facilities for the hire-purchase of electrical appliances, and that they have no assisted wiring scheme." Hire-purchase facilities and assisted wiring are declared by the Union to be particularly important in an area such as this, which has a considerable working-class population.

Perhaps it would not be very far from the truth if we suggested that the outstanding efficiency of the gas service in Kensington may have unconsciously influenced this branch of the Citizens' Union in their judgment as to what constitutes adequacy in connection with the supply of electricity. The Secretary of the Electric Company, however, according to the Special Correspondent of the *Evening Standard*, has another explanation to offer. He says that the percentage of users of current in the area is small as compared with other places "because a large proportion of the population have low incomes."

Be this as it may, having admitted our sympathy with the Company in being called upon to meet what is, to put the matter mildly, a charge of backwardness in the struggle for new business, we would add that the story, like most stories, points a moral—or rather morals. The mouthpieces of an area which "has a considerable working-class population" are in favour of an "adequate" two-part tariff and "sufficient facilities" for the hire-purchase of appliances. These are topics that have been widely discussed in our own Industry, and if the arguments are sound in the case of electricity, must they not apply with equal force to gas? The second moral is more for the consideration of electricians themselves. The reason assigned by the Secretary of the Notting Hill Electric Light Company for the fact that the percentage of users of current in the area in question is relatively small—because a large proportion of the population have low incomes—should give pause to those enthusiastic electricity-undertaking-owning municipal authorities who have succeeded so far in convincing themselves that the one thing above all others which working-class council house tenants desire is a plentiful supply of electricity for the fulfilling of functions that can mostly be performed more cheaply, and more satisfactorily from the point of view of the user, by gas.

Forthcoming Engagements

Mar.

5.—B.C.G.A.—South Wales District Conference at Cardiff.
5.—MIDLAND JUNIOR ASSOCIATION.—Meeting. Lecture on Refrigeration.
7.—SCOTTISH JUNIOR ASSOCIATION.—Joint Meeting in Edinburgh. Paper by Mr. H. Kerr.
9.—I.G.E.—Finance Committee, 1.45 p.m.; Membership Committee, 2.15 p.m.; Council Meeting, 3 p.m.; General Purposes Committee, 5 p.m.
10.—I.G.E.—Council Meeting, 10 a.m. (resumed).
10.—N.G.C.—Central Executive Board Meeting, 3 p.m.
11.—I.G.E.—Board of Examiners, 10.30 a.m.
11.—FEDERATION OF GAS EMPLOYERS.—Central Committee Meeting, 28, Grosvenor Gardens, S.W. 1, 11.30 a.m.
12.—B.C.G.A.—Annual Meeting of Members in the Southern District, 28, Grosvenor Gardens, S.W. 1.
12.—MIDLAND ASSOCIATION.—Annual General Meeting. Grand Hotel, Birmingham, 2.30 p.m.
13.—MANCHESTER ASSOCIATION.—Annual Meeting and Luncheon, Midland Hotel, Manchester.
13.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Meeting. General Discussion. Evening.
14.—SCOTTISH WESTERN JUNIOR ASSOCIATION.—Annual Business Meeting. Address by Mr. D. Fulton.
15.—WALES AND MONMOUTHSHIRE JUNIOR ASSOCIATION.—Meeting at Swansea. Paper by Mr. D. E. Wilkins.
17.—I.G.E.—Education Executive Committee, 2.30 p.m.
18.—B.C.G.A.—Executive Committee Meeting, 11.30 a.m.
19.—I.G.E.—Refractory Materials Joint Committee, 2.30 p.m.

1936 "JOURNAL" DIRECTORY

Page 56. RAWMARSH. J. Powdrill appointed E. & M.
Page 60. SCARBOROUGH. G. L. Wearing appointed S. vice J. W. Nalton, retired.
Page 76. WOKING. W. H. Ely, E. & M., retired.
Page 88. LANGHOLM. J. S. M'Laren appointed E. & M.
Page 94. BALLINA. T. J. Reid, deceased.

Personal

At the annual meeting of the Scarborough Gas Company, held on Feb. 17, the Chairman, Mr. F. C. Whittaker, called attention in his Address to the retirement at the end of this month of the Company's Secretary, Mr. J. W. NALTON, who has been with the Company for more than forty years. The Board have appointed the Assistant Secretary, Mr. G. L. WEARING, to succeed him.

* * *

Tributes to the excellent work carried out by Mr. J. T. HAYNES, who is resigning his position as Engineer and Manager of the Rotherham Gas Department in order to take up his duties at Stretford, were paid at a gathering at the Cross Keys Hotel, Rotherham, on Feb. 18.

Alderman R. Kirk, Chairman of the Rotherham Gas Committee, presided, and those present in addition to Mr. Haynes, included Mr. W. H. T. Johns, the new Engineer and Manager, Mr. J. W. Holroyd, Distribution Superintendent, Mr. W. G. Emerton, Chief Clerk, and about forty members of the staff. Alderman Kirk expressed regret at the departure of Mr. Haynes and wished him well in his new position. He also welcomed Mr. Johns. A suitable presentation was made to Mr. Haynes by Mr. Holroyd, who said that the fact that Mr. Haynes was going to a very good appointment was the only consolation they had on his departure. He also took advantage of the opportunity to welcome Mr. Johns, whom he assured of the wholehearted co-operation of the staff. Thanking the company for their kind gift and good wishes for his future success, Mr. Haynes paid tribute to the excellent support he had received from the staff at all times during his Managership at Rotherham.

Mr. Haynes was later the recipient of a presentation from the workmen of the Gas Department. The presentation was made by Mr. J. W. Montgomery, one of the oldest men in the service of the Department. Mr. Haynes suitably returned thanks.

* * *

At the Annual General Meeting of the Colchester Gas Company, held on Thursday, Feb. 27, Mr. GERALD CARR BENHAM, M.C., was elected a Director in place of the late Major N. A. C. de H. Tufnell. Mr. WILLIAM WALTER TOWNSEND, M.Inst.Gas E., was elected Managing Director and retains the position of Engineer.

* * *

At a meeting of the Accrington District Gas Board on Feb. 27, Ald. J. Barlow, Chairman, congratulated Mr. E. POWDRILL on his appointment as Manager of the Rawmarsh Gas Undertaking. Mr. Powdrill, he said, had given splendid service during nine years with the Board. He was the eighth assistant trained under Mr. Harrison to secure responsible positions elsewhere. It was decided to place on record appreciation of Mr. Powdrill's services.

Obituary

The *Irish Independant* announced that Mr. T. J. REID, of Ballina, died suddenly at his residence, Carromore House, Curroy, Ballina, Co. Mayo, on Feb. 23.

Mr. T. J. Reid was the proprietor of the Ballina and West Port Gas-Works, where he has resided for many years. He was a very popular man, especially among his own profession. He joined the Irish Association in 1895 and was President at the Annual Meeting in Dublin in 1907. He continued actively to support the Association until last year. T. J. Reid was born in the profession, his father being Manager at Waterford for many years. His uncle, who died a short time ago, was Manager at Longford and later at Malta.

* * *

Mr. FRANCIS PRIESTMAN, the well-known Durham and Northumberland colliery owner, and a Director of the Newcastle-upon-Tyne and Gateshead Gas Company, died at Shotley Bridge (Northumberland) on Feb. 28, aged 80.

Correspondence

The First Slot Meter

SIR,—To make the record of the invention of the slot gas meter historically and chronologically correct, I would inform you that R. W. Brownhill obtained a patent in May, 1887 (No. 7412), and I did the same in November, 1887 (No. 15410), with subsequent patented improvements in 1889, 1891, and 1893. I believe Messrs. Thorp & Marsh obtained their first patent in 1889.

I am not aware that Brownhill's meter was put into practical use, but those under my patents were being used at that period.

Yours, &c.,
W. E. PRICE.

Heather Hills,
West Chobham,
Surrey,
Feb. 29, 1936.

The Combustion of Coke

Progress Report of Midland Coke Committee

We have just received the 1935 Progress Report of the Midland Coke Committee, the work of which is carried out under the direction of Professor R. V. Wheeler in the Department of Fuel Technology of Sheffield University, and at neighbouring coke oven and blast furnace plants. The staff is under the supervision of Dr. R. A. Mott.

As part of the laboratory work, tests have been made on the combustion of coke at slow rates in a furnace 8 in. diameter using coke of ¼-1¼ in. size at rates of combustion under 10 lb. per sq. ft. per hour, such as are adopted in central heating and domestic hot water boilers. It has been found that, even at the limiting rate of combustion—namely, 1-2 lb. per sq. ft. per hour, all the oxygen is removed from the indrawn air within 3 in. of the grate level. These tests, with others made earlier, show that, when combustion is maintained, oxygen is removed from the air supply irrespective of its rate of supply and that the rate of combustion is due primarily to the rate at which air is supplied. The tests have also shown that the slower the rate of air supply (and therefore the rate of combustion) the lower is the maximum temperature. At very slow rates of combustion the temperature is too low to cause much reduction of the carbon dioxide first formed and the gases leaving a bed 12 in. deep may contain only 6% or less of carbon monoxide.

A series of tests on the resistance of coke to gas passage has been made in which air has been passed at varying rates through beds of coke of different screen sizes, and of varying depths. The resistance of the beds to air passage has been measured to enable the laws relating the various factors to be elucidated.

Further tests have confirmed the earlier deduction that any coke, however unreactive, can be burnt in a domestic grate if sized between 1 and 1½ in. square mesh, but that the time to attain a bright fire is directly proportional to the reactivity as measured by the "Critical Air Blast" test of the Northern Coke Research Committee, the time being, however, prolonged if the ash content is excessive, and reduced if below the normal. A very unreactive coke can only be used of this limiting size, a small change in size to 1¾-1½ in. being sufficient to make it fail to burn, or to take an abnormal time to attain a bright fire. The more reactive a coke is the higher the upper limit of size (up to about 2½ in.) which can be used satisfactorily. Sizes below about 1½ in. offer so much resistance to air passage that a satisfactory rate of combustion cannot be maintained. Although coke of 1-1½ in. may be thermally the most efficient—*i.e.*, may give the highest radiation of heat per lb. of coke burnt—larger sizes give a pleasanter fire. It is therefore preferable for open grate coke to be fairly reactive, but even the most reactive low-temperature cokes require to be burnt on a grate (instead of on a solid hearth as is possible with good house coal) and the ash content should be very low to give a pleasing performance.

Preliminary results have suggested that coke used for the smallest domestic hot water boilers, which are required to burn at a rate of only 1·0 lb. per sq.ft. per hour to keep alight overnight, should be more reactive than is indicated by a Critical Air Blast of 0·065.

The Report states that the British Standard Methods for the sampling of coke at a user's works have sometimes been found to be unsatisfactory. Tests made to investigate the difficulties involved have shown that the loss of moisture on exposure of coke to the air may be sufficiently rapid to give low values for coke sampled at 1 ft. depth in wagons. Further work is required.

News in Brief

A Loan of £26,992 for the scheme of modernizing the Abertillery U.D.C. Gas-Works has been sanctioned by the Ministry of Health.

To Put Chesterfield "on the Map" the Gas Department are making a substantial contribution towards the cost of a publicity scheme sponsored by the Development Committee.

A New Gasholder is to be erected by the Paisley Town Council at a cost of £37,000, at their McKenzie Street Works. This has been found necessary owing to the increased consumption.

No Increases in the Price of Gas in connection with the extra shilling on coal will be effected by the following, among other, undertakings: Chesterfield, Edinburgh, Newcastle, and Stoke-on-Trent.

A Series of Cookery Demonstrations and an exhibition of modern gas appliances are being given by Dunfermline Corporation Gas Department in Palmuir Hall, Dunfermline, each day of this week.

Dividend Warrants for the half-year ended Dec. 31, 1935, were posted on Feb. 25 by the South Shields Gas Company at the following rates both less income-tax: Consolidated stock 4¼% and ordinary stock 2⅞%.

That a Reduction of 10% in the price of gas for all consumptions in excess of 10 therms should be considered in the present quarter has been recommended by the Gas and Electricity Committee of the Darlington Corporation.

The Midland Association of Gas Engineers and Managers are holding their Annual General Meeting at the Grand Hotel, Birmingham, on Thursday, March 12, at 2.30 p.m., when Colonel G. S. Eunson will deliver his Presidential Address.

Application for a Special Order under the Gas Undertakings Acts 1920 to 1934 is intended to be made to the Board of Trade by the Banbury Gaslight and Coke Company with the object *inter alia* of acquiring certain lands for gas-works purposes.

Application to the Ministry of Health to borrow £18,000 is being made by the Darlington Town Council for the provision of a water gas plant, buildings and foundations, a boiler and oil tank, and for alterations to mains required in connection with proposed coke oven gas supply.

Under "Situations Wanted" there appeared in a provincial daily last week the following advertisement: "Refined general maid, experienced, excellent cook, seeks post, small modern house with Regulo Gas Cooker; good references." One more proof that the refined, experienced, and excellent cook really does know what is what.

The Manchester Association of Gas Engineers are holding their Annual Luncheon at the Midland Hotel, Manchester, on Friday, March 13, at 1 p.m. Colonel W. M. Carr, President of The Institution of Gas Engineers, will give an Address. At 2.30 p.m. will follow the Annual Meeting, when Mr. A. L. Holton, of Manchester, will deliver his Presidential Address.

An Increase of 10,874,000 cu.ft. over the corresponding month of last year in the make of gas for the month of January was reported to the Aberdeen Town Council on Feb. 26, the total quantity made being 190,673,000 cu.ft. Although 106 fewer tons of coke was sold the revenue from this source increased by £118. Tar products and ammoniacal liquor also produced £381 more revenue.

The Question of Street Lighting again occupied the attention of the Cambridge Town Council recently when after a lengthy discussion the Committee's recommendation for carrying on with gas and for further extending the mileage of streets with improved lighting were approved. It was also agreed to allow for an extra £1,000 a year in the estimates for improving the lighting of side streets.

An Enquiry Was Recently Held into the Ballymena Urban Council's application for sanction for a loan of £2,275 for a gasholder to replace one 40 years old. Mr. C. W. Surman (Gas Manager) expressed the opinion that the old holder was unsafe. The Council had accepted the tender of Messrs. Robert Dempster & Sons, Yorkshire, for the work. The loan would not necessarily affect the price of gas. Existing loans on the gas-works department, it was stated, had been reduced within the past year by amounts not far short of the present intended loan.

A Visit was paid by the members of the Folkestone Townswomen's Guild to the Folkestone Gas-Works by kind invitation of the Manager, Mr. G. le B. Diamond. In the Board Room at the Gas Company's Offices the visitors were shown films illustrating the production of gas, light, and heat. Mr. Diamond offered a prize to the Townswomen's Guild for the best cake baked by gas by any member.

An Increase of 225 million cu.ft. in the output of gas from the Glasgow Corporation Gas Undertaking since June 1 as compared with the corresponding period of last year was intimated by the Convener of the Gas Committee, Bailie John Young, at a recent meeting of the Committee. He attributed the increased consumption to the improved industrial conditions, extended domestic use of gas, and increased demand due to weather conditions.

For the Improvement of Gas Supply to the whole of the town an extensive scheme was suggested by the Gas Committee to the Aberdeen Town Council on Feb. 26. With the growth of housing schemes in the outskirts of the town there has been a diminution of pressure in the supply to more centrally situated areas. A high-pressure main will be laid throughout the town, being approximately 7,000 yds. long. About £11,500 will be involved in the scheme and the cost will be met out of the Department's reserves.

Fish Frying Demonstrations to members of the fish frying trade were given by Mr. R. Wilkinson, of the Acme Engineering Company, Ltd., at the County Road Showroom of the Liverpool Gas Company on Feb. 24 and 25. The range on which frying tests were conducted was the "New Acme," and the results of the talks and demonstrations, we are informed, considerably exceeded the expectations of the Gas Company. Fifty members of the trade attended the first, and sixty the second, demonstration.

A Ten-Years Lighting Contract for public lighting has been entered into by the Margate Corporation with the Westgate-on-Sea and Birchington Gas Company who have reduced the price of gas for public street lighting from 1s. per therm, less 10%, to 7½d. per therm, less 5%. Margate Corporation are to pay an inclusive annual charge for rental and maintenance. The Corporation, however, reserve the right to adopt other forms of lighting on seafront roads and promenades, principal shopping centres, and the main Canterbury Road.

Spacious New Showrooms in Station Road, Birchington, have been opened by the Westgate and Birchington Gas and Water Company. This is the second new showroom provided in the district since the Undertaking has been under its present ownership. With the increase of business in the area, it was felt that the old premises were inadequate and the Directors decided to provide the very latest for the benefit of their consumers. Simplicity and modernity are the keynote of the new showrooms at Birchington. The exterior is illuminated by chromium-fitted lamps.

An Exhibition of large-scale cooking equipment was staged last week by the Broadstairs Gas Company in conjunction with Messrs. J. Wright & Co., at Anderson's Café, Victoria Parade. The exhibition was well attended and the interest displayed by the proprietors of hotels, cafés, boarding-houses, &c., fully repaid the Company for their efforts, the business which accrued being most satisfactory. The "Guesthouse" range appeared to be the centre of attraction and a feature which was much appreciated was the introduction by the Company of a new two-part catering tariff.

Speaking at the Meeting of the National Smoke Abatement Society held in Manchester, Dr. John S. Taylor, Assistant Medical Officer of Health for the City, said that to-day in Manchester 3 million tons of coal were burned annually, of which 750,000 tons were used for domestic purposes. Eleven hundred factory chimneys and 150,000 houses were continuously discharging the products of the incomplete combustion of these millions of tons of coal. As a result some 20,000 tons of solid matter fell in the city area each year. Lord Stamford, who presided, recalled a conversation which he had some years ago with the late Mr. C. P. Scott, who told him that fifty years ago dense black fogs were quite common in Manchester, whereas in recent years they rarely occurred. He attributed that change for the better to the wise and enlightened policy of the Manchester Corporation itself and the Manchester Gas Department of installing gas cookers in houses free of charge.

The Women's Gas Council

Cardiff.

The Inaugural Meeting of the Cardiff Branch of the Women's Gas Council will be held at the City Hall, Cardiff, on Thursday, March 5.

West Ham (Forest Geat).

Following on their successful meeting at Southend on Feb. 18, the Gas Light and Coke Company are organizing a meeting on behalf of the Women's Gas Council in the Forest Gate area of West Ham, to take place at 3 p.m. on Thursday, March 12, in the Earlham Hall, Earlham Grove. At this meeting Dr. R. King Brown, Chairman of the Executive Council of the Institute of Hygiene, former Medical Officer of Health for the Borough of Bermondsey, and late Lecturer in Public Health at Guy's Hospital, will give a talk on "Health in the Home." The Chair will be taken by the Chairman of the Stratford Division of the British Medical Association.

Miss Halpin will also address the meeting on the objects of the Women's Gas Council and invite those present to join.

A Conference on Housing

A conference on housing was held by the Women's Gas Council at the Millicent Fawcett Hall, Tufton Street, Westminster, on Monday, March 2, the chair being taken by Sir Francis Goodenough, C.B.E. There was a splendid attendance and a lively discussion followed the addresses.

Sir Francis Goodenough introduced Sir Percy Alden and Miss Elizabeth Denby, two well-known authorities on housing problems.

In the course of his remarks, Sir Percy said if they could improve the housing conditions of at least two million people in this country who were either below or near the poverty line, they would eliminate an immense amount of disease and suffering and the general death rate and infant mortality rate would be lowered.

Their mistake in the past had been that they had tried to recondition instead of building anew. To-day they seemed likely to make a clean sweep of slum dwellings, which augured well for the future. In five years' time they would have rehoused 1,250,000 slum dwellers. New dwellings, whether cottages or blocks of flats, must be at economic rents for the workers and must be fitted with appliances for comfort and convenience. Gas undertakings offered many advantages in this direction, for they were willing to provide gas at any point in the house where required and could give an excellent service of hot water without trouble.

Miss Elizabeth Denby said that men left home daily for their work, where they met friends and so obtained a change. They should consider whether women too did not need their "factories" or kitchens planned so that, as workers, they need not be isolated during the day, while still preserving their privacy for family life.

She went on to mention what she considered essentials in any town planning or building scheme. The new estate, she said, must have sun, light and air, transport facilities to carry people to their work, and easy play facilities close at hand. New areas should be planned and equipped as a whole, with the greatest economy and efficiency of gas and other public services. Finally, the planning and equipment of individual dwellings should be thought of in terms of the needs of the occupants, rather than of the type of dwelling which qualified for a subsidy.

The proceedings were followed by tea.

Glasgow's Coke Oven Gas Supply

Contract Terminated

The Glasgow Corporation has decided to terminate the present contract between the Gas Department and Messrs. James Nimmo & Co. for a bulk supply of coke oven gas from the Company's works at Auchengeich.

Mr. E. M. Dalglish, seconded by Bailie Victor D. Warren, moved that the proposal to terminate the contract be continued until the report on the gas grid scheme was available. Bailie Victor Warren said it would not be good business nor in the best interests of the Corporation that the mains between Provan Gas-Works and Auchengeich should be pulled up when at a later date they might require to take coke oven gas from Messrs. Nimmo.

In view of the possibility of the formation of a gas grid in the West of Scotland the Corporation ought to delay its decision with regard to the contract with Messrs. Nimmo.

By 58 votes to 32 it was decided to terminate the contract.

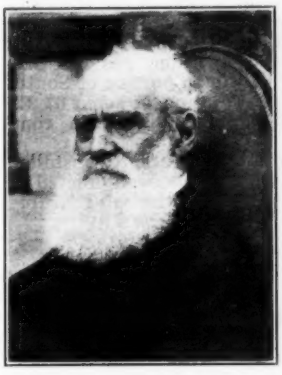
In discussing this matter with our Scottish correspondent, Mr. Dickie (Manager of Auchengeich Coking Plant) stated that the 10-year contract for supplying 2 million cu.ft. of gas per day to the Glasgow Corporation expires at an early date, and that it would obviously be unwise on the Corporation's part to renew the contract in view of the possibility of the formation of a gas grid and the offers of supply of gas which had been received from Messrs. Wm. Baird and Messrs. Wm. Dixon.

Jubilee of Clayton, Son, & Co., Ltd.

Presentation to Mr. Joseph Clayton

In the year 1862 the late Lawrence Clayton, who was then but 20 years of age, was filled with ambition to carve out a career for himself in the Engineering Industry.

He had served some years with Mabons, gasholder makers, Gorton, Manchester, and had also been practically tutored by his father, Leonard Clayton, who was then living on the borders of Lancashire and Yorkshire, combining farming with boiler making, and where engineering problems drawn out with chalk on the stone floor of the farmhouse were the subject of nightly discussion between the two. Later, he and his father took possession of a small workshop situated in Belinda Street, Hunslet. Here they arranged to try their fortunes in securing some of the orders for gasholder and boiler work which were being placed by the rapidly developing towns of Yorkshire and Lancashire in the early 60's.



Mr. LAWRENCE CLAYTON, 1842-1926, Founder of the Firm with his Father in 1862.

Mr. JOSEPH CLAYTON, Chairman and Managing Director and son of Mr. Lawrence Clayton.

It meant hard work for capital was scarce and plant had to be acquired by degrees, but father and son revelled in the struggle. The partners had to act both as staff and workmen, estimating, travelling, obtaining orders, and taking part in the actual construction and erection.

After thirteen years at Belinda Street a footing was obtained in the engineering world, and in 1875 Mr. Lawrence Clayton, who by this time was carrying the bulk of responsibility, resolved that a move forward must be made if larger work was to be undertaken. He realized that the Belinda Street Works were cramping enterprise, and so he made a bold move and acquired the Moor End Estate, Hunslet, which comprised 12 acres. From this point the fortunes of the Company developed and prospered, and in 1886, for convenience of working, the business was formed into a private limited company. In due course the Pepper Road and Dartmouth Works were added, bringing the total area up to 22 acres.

The Jubilee Year of the formation of the limited company was celebrated at the 50th annual general meeting of shareholders on Wednesday, Feb. 19, when, after the formal business of declaring a dividend, a suitable presentation was made to Mr. Joseph Clayton, Chairman and Managing Director, as a mark of their appreciation and esteem on behalf of the shareholders by Mr. John J. Baines, who has been with the Company for 56 years. Mr. Clayton's fifty years term of service also happily synchronized with the Company's Jubilee, since he started as a youth in 1886. The articles presented to him included an antique Chippendale wine table, dated 1760, and a silver cigar box. Great jubilation prevailed at the Works, and every member of the staff, workmen, and boys received a bonus in honour of the occasion.

Gas Lighting Developments at Southport

Gas Illuminated Traffic Bollards

The important progress which gas is making in the Southport district in face of severe competition is very noticeable in the lighting arrangements of the Borough.

Quite recently all the main 'bus routes throughout the Borough have been illuminated with centrally-suspended high-power lamps. The disused tram poles formerly utilized for the support of the overhead wiring in the tramway system recently discarded have been brought into service for this purpose, and a very high standard of illumination has been effected. In face of competition, gas has also been adopted for the lighting of the north portion of Southport's fine promenade, and an installation of some 37 12-burner high-power ornamental lanterns has been completed.

Our photograph shows one of the 18 recently installed gas illuminated traffic bollards which have been erected at various parts of the Borough to assist in the safeguarding of pedestrian traffic.

The Scammell Mechanical Horse

A Useful Haulage Unit

The past ten years have seen a phenomenal revival in the use of the road for the conveyance of passengers and merchandise of all kinds, both light and heavy. During this period of development, British manufacturers of commercial vehicles have grappled with the situation, producing vehicles to meet the changing conditions.

Among the important motor manufacturers are Scammell Lorries, Ltd., the pioneers of articulated six and eight wheelers, who have made a number of important contributions towards greater efficiency and increased earning power of transport. The scope of their activities is evidenced by two such dissimilar vehicles as the Scammell Mechanical Horse for short distance transport in busy cities, and the Scammell Rigid Six and Eight Wheelers for heavy long-distance transport.

The Scammell Mechanical Horse has proved its amazing abilities by its strenuous, day-in-day-out performance in the service of railway companies, public authorities, haulage contractors, and industrial concerns. It has entirely revolutionized short-distance collection and delivery work and haulage.

This type of vehicle consists of a three-wheeled tractor unit, made in two sizes for hauling 3-ton and 6-ton loads respectively, to which is attached by superimposition through a turntable a two-wheeled carrier or semi-trailer unit. The latter is instantly attachable or detachable by means of a simple automatic coupling and releasing device operated from the driver's seat. At its forward end, the carrier is fitted with jockey wheels held normally clear of the ground, but used for supporting the carrier unit when the tractor is disconnected.

All motive units and carrier units are interchangeable; thus the Mechanical Horse can be employed with a fleet of trailers, hauling one while others are being loaded and unloaded. This adaptability enables the portion of the vehicle which carries most of the capital cost, taxation and overhead charges to be kept constantly at work, whereby its earning capacity is considerably increased.

The motive unit together with a standard 3-ton carrier turns in a circle of 15 ft. without reversing, thus is it able to negotiate narrow streets, sharp turns, and dense traffic of dock areas and busy cities easily and quickly.

Special types of carriers are made to meet the requirements of different users, and the hundreds of Mechanical Horse vehicles in use provide striking evidence that this machine is putting short-distance transport on an entirely new and much more profitable basis.

Tarred Roads

Non-Skid Properties

Sir Reginald Clarry, M.P., Chairman of the British Road Tar Association, last Monday conducted a party over a number of roads north of London in a tour designed to show how the tarred road surfaces have retained their non-skid qualities under the test of heavy traffic.

Of the roads visited, the best example of surface was the section of Watling Street near Dunstable. The road is constructed of tarmacadam surface-treated with grey ½-in. granite chippings and is a remarkable illustration of road surface treatment with tar at its best. The section was laid in 1935 and extends for over two miles. The whole stretch has stood the heavy traffic strain—estimated at 26,000 tons a day—most satisfactorily and shows no signs of disintegration. The fine quality of tar employed assures a complete binder and the granite chippings thus firmly held provide an excellent non-skid surface.

Dunstable High Street was visited as an example of a surface which is subjected to the particular strains of traffic conditions on the main thoroughfare of a town, such as heavy and irregular traffic flow, a large amount of braking, and the pulling-up and re-starting of all types of vehicles, especially heavy omnibuses. The street is of tarmacadam, surface-dressed with tar in 1934, and is still in first-class condition. Other roads which were inspected showed the use of Leicestershire pink granite and of Bedfordshire chinks.

British Refractories Research Association

Appeal for Greater Support

At a representative gathering at the Hotel Metropole, London, last Wednesday, presided over by Col. C. W. Thomas, Chairman of the British Refractories Research Association, at which leaders of industry from all over the country were present, powerful appeals were made for further industrial support of the Research Association from the industries served by it and for the extension of its activities to research on building bricks, tiles, and other clay products. Strong pleas were also made for much stronger support from the pottery industry, whose previous support had been very small.

Lord Rutherford, the Chairman of the Advisory Council of the Department of Scientific and Industrial Research, referred to the recent progress of the research association movement and said: "We on the Council were somewhat exercised 18 months ago when we reviewed the position generally to find on what an inadequate basis some of the Research Associations were operating. We came to the conclusion that a big effort must be made by all concerned to place these organizations on a firmer and more stable financial footing, and we succeeded in convincing the Government that it should play its part in the forward movement. I am delighted to be able to say that the impetus thereby given has had an immediate and effective response from practically all the industries with which we are concerned which represent something like half the export trade of the country. One or two of the Associations have not yet made proposals to play their part, and the one I have in mind particularly this afternoon is the British Refractories Research Association. Some increase in recent years in the resources of the Refractory Association has been secured, but even so the subscription income from trade sources is under £5,000 a year and the total income from all sources is only just over £8,000. The minimum income which the Association ought to have to cope with work for all the interests concerned is not less than £20,000 a year, a sum which would represent less than £1 per £1,000 of output."

Sir Clement Hindley, Chairman of the Committee of the Advisory Council which deals with grants to Research Associations, reviewed the history of the Refractories Research Association and its position to-day. From its inception in 1920 to 1932—that is, for 12 years—the Association, he said, had received a grant from the Department on a £ for £ basis. In 1931-32 the industry produced a subscription income of £1,800 and received the same sum

from the Department, together with a contribution from the Iron and Steel Federation of £500, making a total of just over £4,000 a year. In June, 1932, the minimum industrial income of the Association increased to £5,000 a year, the users of refractories taking a prominent share in providing the increased income.

He appealed to the potters of the country to reconsider their whole attitude towards scientific research and become members of the Refractories Research Association on a very different financial footing. "I should like to see," said Sir Clement, "the brick and roofing tile industries joined up at the same time, and to find the new premises at Stoke enlarged to house the whole of the activities embraced thereby."

Athletic and Social

Cardiff Gas Company's Athletic and Social Club.

The Fifteenth Annual General Meeting was held on Feb. 22, 1936. The meeting was followed by a dinner, which was concluded by a programme of musical items.

The Report of the Council for the year ended Dec. 31, 1935, states that the accounts show a credit balance on the year's working, and this was mainly accounted for by the fact that the Annual Sports yielded a small profit as well as being successful in every other way. Credit for this is due to Mr. A. W. Stickler (Hon. Sports Secretary) and his Committee, and to favourable weather conditions. The Council did not desire to secure profit so much as to give the maximum benefit possible to the various branches of the Club's activities. The year was successful in every section—viz., association football, cricket, harriers, lawn tennis, bowls, skittles, and air rifle. The harriers section were entrusted with the promotion of the cross country novice championship, which attracted a large number of runners from South Wales and Monmouthshire. Bowls, skittles, and cricket competitions were held and prize awards will be made at the Annual Meeting. The H. D. Madden (Challenge) Cup was secured by Bute Terrace Works, and the H. D. Madden (Bowls) Challenge Cup by Mr. W. Griffin.

Portsmouth Concert and Long-Service Awards.

There is no doubt that the Portsmouth and Gosport Gas Company are one happy and contented family. There was further evidence of this at the Oddfellows' Hall, Kingston Road, on Feb. 27, when a variety concert was excellently staged.

Most of those who spoke referred to the loss of the "head of the family" through the lamented deaths of Mr. T. H. F. Lapthorn, Chairman, and of Mr. W. Gillman, the Deputy-Chairman of the Company.

Mr. T. Carmichael, the General Manager, who is now Deputy-Chairman of the Company, introduced recipients of gifts, certificates, &c., as "fellow workers and friends," and that was the underlying spirit of the gathering. The new Chairman of the Company, Alderman Dr. F. E. Beddow, D.Sc., Ph.D., J.P., presided, and was supported by Mr. Carmichael, Messrs. F. Kilpatrick, and F. R. Snook, Directors, R. W. Hewitt, Secretary, and E. Allison, Engineer.

There were presentations to the following employees who are retiring: Messrs. T. W. Millett (36 years' continuous service), J. H. Austin (32), W. F. Russell (32), C. H. Harley (21), F. W. Lampard (21), M. Norfolk (14), and J. Carter (11).

Long service awards went to Messrs. T. F. Stallard, A. H. Fryer, C. H. Thomas, and J. Louth, while the following received long service certificates: Messrs. D. Bramble, W. J. Prior, C. Stride, C. A. W. P. Walker, A. W. Quick, H. Thorn, E. C. Brister, W. H. Chase, T. H. Corbin, J. F. Corbin, H. S. Howard, W. C. Lummis, F. Wigmore, H. Toomer, E. J. Aylmer, A. W. Campbell, J. Loach, A. J. Radley, H. R. Payne, and E. Smith.

Mr. Carmichael went on to congratulate Dr. Beddow, on being elevated to the Aldermanic Bench of the City Council. Dr. Beddow expressed to the employees who had served the Company so long and so loyally the best thanks of the Directors.

Mr. T. W. Millett and Mr. F. Lampard voiced the thanks of the recipients to the Directorate, and Mr. T. Kilpatrick fittingly expressed appreciation of all the work done by Mr. D. Marwick (Chairman), Mr. P. B. Hayward (Secretary), and the Committee of the Social and Athletic Club for the efficient way the function had been organized.

Willey & Co., Ltd., Athletic and Sports Club Dinner.

More than 170 members of Willey's Athletic and Sports Club gathered in a festive and friendly atmosphere at Deller's Café, Exeter, on Feb. 24, for the club's second annual dinner and concert. The club members are all employees of Messrs. Willey & Co., Ltd., and the Vulcan Stove Company, Ltd., and altogether they number about 1,200.

The Chairman was Mr. F. B. Roberts, and among others present were Mr. Thornton Willey (President), Sir Charles L. Morgan, C.B.E., and Messrs. T. Glanfield, S. E. Cash, and R. F. Blanchford (Vice-Presidents), all of whom are Directors of the Firm, Mr. R. J. Rew, and Mr. C. H. Hitchen (General Manager). Proposing "The Future Prosperity of Willey & Co., Ltd., the Vulcan Stove Co., Ltd., and the Directors," Mr. R. J. Rew said the Firm's standing and integrity were never higher than they were to-day, and he suggested that the time had come for the Directors to consider a scheme to provide in some measure for the retirement of the older employees.

Mr. S. E. Cash responded on behalf of the Directors, and apologized for the absence of Mr. Fred Blanchford (a Director and Vice-President). A vote of thanks to the Chairman of the Sports Club was proposed by Mr. C. H. Hitchen. Replying, Mr. Roberts expressed the Club's appreciation of the sub-Committees, Ladies' Committee, and Entertainment Committee, who had all helped to make the past year so successful. The dinner was supported with an excellent musical programme.

Wolverhampton Staff Dance.

The second annual staff dance of the Wolverhampton Gas Company was held at the Victoria Hotel, Wolverhampton, on Feb. 26, when a company of about 150 spent a very pleasant evening.

Scottish Junior Gas Association (Western District)

Visit to Kingshill Colliery

An interesting visit to Kingshill Colliery was enjoyed by 34 members of the Scottish Junior Gas Association (Western District) on Saturday, Feb. 22.

The smithy and repair shop, where all plant repairs are carried out, was first inspected. The winding engines were then seen in operation; one winds cages from a depth of 1,000 ft. and the other from 1,200 ft. In one shaft double deck cages are used, and these take 4 hutches, containing 3 tons of coal in all, per wind. Each wind of 1,000 ft. is accomplished in 29 seconds (a maximum speed of 55 miles per hour being attained), and only 5 seconds are required for replacing the full hutches by empty ones. An average of 80-85 winds are made each hour. The hutches are emptied by means of rotating "tumblers" on to screens, where all the coal below 2½ in. is removed. The round coal passes over picking tables into wagons and the smalls to a Baum washer.

The ambulance room, baths, changing and drying rooms, and canteen, built and equipped by the Company at a cost of £12,000, were then visited. Sun-ray and ultra-violet ray apparatus are installed.

The party was then taken down the 1,000 ft. shaft to the coal face of one of the nearest sections. There the coal cutter and conveyor were examined.

Only 10% of the men are employed at the coal face. The others attended the conveyors, loaders, locomotives, &c. The Coltness Company hold classes for training the men for the various jobs.

The party were subsequently entertained at tea by the Company, when Mr. RITCHIE (General Mining Manager) extended a warm welcome to the Association and hoped they had all enjoyed their visit. Mr. MACDONALD (Assistant Mining Manager) stressed the difficulties arising from the increasing length of the roadways. The shift started when the men went down the pit, and much time and energy would be spent in getting to and coming from the coal face. They had recently installed a haulage system for the men.

Mr. J. GREIG (Glasgow) expressed the Association's appreciation of the hospitality shown to them that day. It had not only been extremely interesting for them to see the work entailed in the winning and preparation of coal for the market, but it was good for them to see the difficulties encountered by others and the great trouble taken to ensure a standard product. The prosperity of the Gas Industry was so much dependent on that of the coal industry. Mr. W. KIRK (Motherwell), the Hon. Secretary, added his thanks.

Mr. RITCHIE said he was very gratified indeed that everyone had enjoyed their visit, and expressed the pleasure it had given him and his colleagues to have them as their guests.

THE JOINT GAS CONFERENCE

at Castle Bromwich

The First Joint Gas Conference to be held under the aegis of the British Gas Federation at the Birmingham Section of the British Industries Fair, took place from Feb. 25 to 27, under the Presidency of the Earl of Dudley.

THE EARL OF DUDLEY, M.C.
President of the British Gas Federation.

Members taking part in the British Gas Federation Joint Gas Conference at the British Industries Fair, Castle Bromwich, assembled on the Tuesday morning under the Presidency of the Earl of Dudley, M.C.

The LORD MAYOR OF BIRMINGHAM (Alderman S. J. Grey), in welcoming the members of the Conference, said he thought it was very appropriate they should have selected the British Industries Fair as the venue of their Conference and particularly that they should do so under the Presidency of the Earl of Dudley, who was himself a very prominent industrialist and also a Vice-President of the Chamber of Commerce which had done so much for the organization of the Fair. In their exhibits the Federation had in mind that it was staging them at a great national Fair and therefore they were showing furnaces particularly suited for the heavy industries. He hoped that their Conference would be useful and fruitful in every way.

The PRESIDENT OF THE BIRMINGHAM CHAMBER OF COMMERCE, who also offered a welcome to delegates, said he was very glad to welcome the Gas Industry back to the fold. There were 75 firms exhibiting in the Gas Section, with a total stand space of 32,000 sq.ft. There was a distinct improvement in the lay-out over previous years, and the Management Committee wished to congratulate the exhibitors on the excellence of their displays. He was particularly pleased to welcome the members of the British Commercial Gas Association, which looked after the sales of gas, because he was of the opinion that the well-being and future of the Industry depended more than anything else on the sales propaganda. The whole Industry had to look to the Association to ensure that their propaganda was carried out on the right lines. He had great pleasure in welcoming the Federation and he hoped the Conference would be a most successful one.

The EARL OF DUDLEY, in returning thanks for the welcome, said the Gas Industry felt that the Fair at Birmingham was a very worthy and a very fitting place at which to hold the Conference. He had been associated with the Lord Mayor during his two years of office, and no more kindly host could be desired. They also appreciated the welcome on behalf of the Chamber of Commerce, and looking at the Fair one could realize the immense amount of work that devolved upon the Chamber by way of organization. Birmingham could be counted to be the cradle of the Gas Industry. The streets of the city, which were lighted by gas, were counted among the best-lit streets in the world. In the re-housing that was to take place he was sure the authorities would be deeply interested in the various domestic uses of gas in its most modern and economic form. As an industrialist Major Smith would be equally interested in industrial uses.

Presidential Address

Of the Rt. Hon. The Earl of Dudley, M.C.

The British Industries Fair is an appropriate meeting place for the First National Conference of the British Gas Federation.

The British Gas Federation was formed, as you know, to make even more effective that co-operation which over a period of years had been achieved between the different Associations representing various activities of the Gas Industry. It acts to-day as the mouthpiece of the Industry on questions of common policy.

The British Gas Federation has been responsible for organizing the Gas Section of the British Industries Fair, and I think you will agree that the Section worthily represents one of the largest industries in Great Britain.

On the Supply side, the British Gas Federation represents Gas Undertakings employing some 126,000 men; on the Manufacturing side it represents the makers of gas-producing plant, gasholders and mains for over 1,000 British Gas-Works, and the makers of every type of gas cooker, fire, water heater, boiler, and furnace.

Collectively, the Federation is responsible for maintaining Gas Service in 11 million households and in an ever-increasing number of factories and workshops.

The British Industries Fair is a world market where every British trade and industry puts its goods in the shop window, so that the visitor may get a bird's-eye view of the country's industrial equipment. Nearly one hundred exhibitors are displaying their products in the Gas Section, and each branch of the Gas Industry has played its part in making that Section a true reflection of the important part which the Gas Industry plays in the life of the nation.

Behind the Gas Section is a story of remarkable progress—the result of unremitting effort on the part of those constituting the British Gas Federation. During the last 10 years, the Gas Industry has added more than two million consumers to its books—an increase of 26% in a period of difficult trade conditions. The present total of eleven million customers means that practically every family in an area of gas supply is using gas in the home. In the same ten years the output of gas has increased by 38,000 million cu.ft.

When these figures are analyzed, some interesting facts come to light. One is that the sales of gas to industry are rapidly increasing. In fact, these gas statistics are a useful guide to trade movements and developments. They give a picture of the emergence of British trade from the depression. In the older industries the adoption of gas for heat processes has been a feature of trade recovery. In Sheffield, which last year recorded a heartening revival in the steel trade, the percentage of gas used for industrial purposes rose from 56% to 62%. In Derby the industrial sales of gas rose from 28% to 35%.

Perhaps the most interesting aspect of the development in the use of gas is the readiness with which the newer industries have availed themselves of the fuel service which we place at their disposal. The manufacturers of motor vehicles, aeroplanes, telephone and radio equipment are compelled by stress of severe competition from abroad to adopt the most up-to-date methods of production, not merely for the purpose of reducing costs, but with the object of ensuring a superlatively good product. Heat-treatment plays a very important part in the products of

these newer industries, and this fact no doubt accounts for their adoption of the most adaptable, the most uniform, and most readily controlled fuel which it is possible to obtain to-day.

In Coventry, the home of motor car manufacture, the industrial sales of gas have risen by 5%. The gas figures show, too, how industry is expanding in the South. In Watford and Maidstone, for instance, the sales of gas to industry were doubled in 1935, and at Slough almost a third of the gas output goes to feed the furnaces of factories and workshops.

The Industrial Gas Exhibit at the Fair, organized by the Federation, shows some of the ways in which gas helps modern industry—furnaces for the heat-treatment of steel, for glass manufacture and non-ferrous metal melting; plastic moulding presses, oxygen cutting machines, muffle furnaces, and industrial boilers.

The intrinsic merits of gas for industrial processes are supplemented by a national system of expert service to the individual manufacturer. A chain has been formed consisting of Industrial Gas Development Centres established at key points all over the country. Each Centre is supported by contributions from Gas Undertakings in the area, and any manufacturer can bring his own special problems to be solved by the Gas Industry's Engineers and Industrial Chemists.

All these Development Centres are linked together by a Central Bureau through which is exchanged information regarding the results obtained by each. In this way the accumulated experience of the Gas Industry is made available to any manufacturer.

Research in the consumer's interest is the soundest way of developing business. This is true whether you are selling to the woman in the home or the industrialist in his factory. Half the secret of successful marketing lies in anticipating the consumer's needs. The Gas Section bears eloquent testimony to this having been done, and the main cause of the Gas Industry's progress has been the improvement in the range, efficiency, and appearance of gas appliances, both industrial and domestic.

As regards domestic supplies, the consumer nine times out of ten is a woman doing all her own housework, administering 75% of the family income, shrewd in her buying, but house proud and anxious to improve her home within the limits of her purse. It is for such consumers that the Gas Industry has produced enamelled cookers with automatic control, automatic water heaters, and self-lighting fires. Nearly all such apparatus can be obtained on hire purchase terms.

This consumer-mindful policy has been overwhelmingly successful. The year 1935 provided a record for the sale of gas apparatus. The latest move has been to bring gas refrigerators within the reach of the ordinary income. Last summer one Gas Company alone sold 1,000 refrigerators in three days, and the manufacturers have been kept busy throughout the winter in anticipation of an immense demand in the coming summer. Naturally, the new and improved types of cooker, fire, and water heater to which I have referred use less gas for equal service than the types which they have replaced, and the effect is seen in the reduced quantity of gas required by the individual domestic consumer.

While the reduced consumption per consumer is from a financial point of view regrettable, yet the Gas Industry has no reason to be fearful as to the ultimate results. On the contrary, it is proud to have been able to provide improved service at lower rates, and as the public comes more and more to appreciate the benefits of gas service—to learn by experience that it is reliable, virtually automatic, and not an extravagance—so will their demand upon that service increase as an important contribution to a higher standard of comfort.

It must be remembered that the last decade has seen a great change in the mode of life of the people. Cheap and frequent transport and the ubiquitous cinema have between them altered the nature of the home, which in many cases has become little more than a place for sleep and occasional hurried meals. Moreover, the nature of these meals has changed, and the amount of cooking carried out in the average household is to-day materially less than in years gone by.

The provision of food and warmth has in large measure become the province of the restaurant and places of amusement.

The slow advance, or even the temporary decrease, in the individual domestic demand for gas service will, however, in large measure be compensated in the future by new loads, and there is every reason to believe that in course of time the public will come to insist upon achieving in their own homes the same standard of comfort with which the cinema and restaurant have made them familiar.

With regard to industrial conditions, the change that is taking place is, as I have already indicated, entirely in our favour. Any business which we may conceivably lose is negligible in comparison with the vast potentialities of gas fuel in the industrial field.

But let it not be thought that our ability to meet satisfactorily these changing conditions of life has come about fortuitously. Such is far from being the case. It has called for unceasing vigilance on the part of all sections of the British Gas Federation. Every item of expense has had to be closely examined; every economy, however small, has had to be effected in order that Gas Undertakings might find themselves in a position to offer rates sufficiently low to prove attractive. Never before has competition been so intense in both the domestic and industrial spheres. On the one hand we find electricity being offered for domestic use at rates which to a public dazzled by the prospect of an " electrical age " appear to be quite cheap. On the other hand, the industrialist, realizing the difficulties inherent in the use of solid fuel, is tempted to substitute imported oil.

I am happy to say that Gas Undertakings in increasing numbers, by exercising strict economy, are finding themselves in a position to offer a service which is at least equal and in many respects superior to that of their competitors, and at a competitive price.

From the realist's point of view, the Gas Industry is one of the youngest industries in the country, and its prospects of playing a yet more important part in the life of the community are brighter to-day than ever before. That all sections of the British Gas Federation will continue to equip themselves to meet the demands of the future is a foregone conclusion. Our Research Departments must be maintained and extended. Our Home Service Departments and our showrooms, already brought to a very high state of efficiency, should become a normal part of the organization of every Gas Undertaking, large and small. The admirable work of the British Commercial Gas Association must be supplemented by publicity and sales propaganda conducted by each individual Undertaking in its own area. The B.C.G.A. will gladly advise how such individual effort can be made most effective, and in this connection I would like to mention that Film Service at the introduction of which I took part last autumn.

An industry with national responsibilities must have a national outlook. Serving practically every family and every trade in the country, our responsibilities are great. We have, I think, endeavoured to fit ourselves to discharge those responsibilities; we have merited the title of " Public Servant No. 1." Our Industrial Gas Exhibit at this British Industries Fair is our " gesture " to the industrial community of the country. It is the evidence of our willingness and ability to assist in every branch of industrial activity, great or small, in which heat is required. The Exhibit of necessity can give but a slight indication of the many directions in which we are prepared to assist, but it should be the duty of every member of the Federation to draw the attention of the industrialists in his area to this Exhibit, and to encourage them to inquire how our industrial gas service can help in the improvement of their individual processes and in the solution of their problems. If this is done, we may look forward confidently to playing year by year an increasing part in the rehabilitation of British industry.

Vote of Thanks.

Sir DAVID MILNE-WATSON, in proposing a vote of thanks to the President, said they all regretted his absence at the Annual Meeting and Banquet of the Federation owing to illness, but they rejoiced to find that he was completely restored to health. They were grateful to Lord Dudley for the interest he took in the Federation. He was a man of wide experience with a great many interests in life. The statistics that Lord Dudley had given were most heartening and illuminating. If there were any who were apt to be faint-hearted, or had been faint-hearted about the prospects of the Industry, he was sure that after listening to that Address their doubts would be dispelled.

Mr. D. M. HENSHAW, in seconding, said it was realized that the establishment of gas as a national industrial fuel was bound to react in a psychological way on the whole country, and it was now apparent from what had been said recently by many people who were alive to the national conservation of coal that the movement which had taken place in adapting gas to various modern furnaces and processes was of premier importance in regard to coal conservation. They felt that future generations, when coal became dangerously scarce, would look back and wonder why the early gas engineers and industrialists did not recognize more clearly the importance of the wider use of both gas and coke as a national fuel.

The proposition was heartily carried and the PRESIDENT replied.

THE JOINT GAS CONFERENCE.

THE USES OF GAS IN Trade and Industry

By
DEAN CHANDLER,
of the South Metropolitan Gas Company

Delegates re-assembled on Wednesday morning, under the Chairmanship of Col. W. M. Carr, O.B.E., T.D., President of The Institution of Gas Engineers, to hear a Paper by Mr. Dean Chandler on "Gas in Industry and Commerce."

Mr. DEAN CHANDLER.

"Gas, the National Fuel," is the title of a recent publication which deals with one important requirement of domestic life. The preface states "that a very great number of homes are happy in the possession of a trouble-free, hot water service, and this has been made possible by gas, the national fuel." But gas is not only the ideal fuel for domestic purposes; it has also a thousand-and-one uses in industry. This was recognized many years ago by Thomas Fletcher, who regarded the use of gas for commercial and industrial purposes as of great value to the Gas Industry. Professor Bone has said "that Fletcher had arrived at a clearer conception than any of his contemporaries about the influence of surface combustion, and as far back as 1887 he demonstrated the possibility of flameless, incandescent surface combustion in contact with suitable materials." One thing is certain. Fletcher realized the far reaching possibilities of the use of gas as an industrial fuel, and he never wavered in his view that the Gas Industry could cater for and specialize in the supply of gas for all those purposes for which "there existed an enormous potential demand."

Fletcher used gas in his own factory at Warrington "with very profitable results." It is said that he never wearied in demonstrating to his friends and visitors to his works that steel could be melted in a crucible by gas, which, to quote his words, "showed the great power of gas."

Fletcher was a master in the design and construction of industrial gas burners and gas-fired furnaces, particularly for small and medium scale operations. The Gas Industry as a whole did not do justice to Fletcher's pioneer work, and it apparently required the conditions of war to awaken the Gas Industry to the great potentialities which existed in industry for the use of gas as a fuel. The urgent needs of war-time necessitated the acceleration of the output of munitions from the workshops and factories which were then under Government control, and the demand for a dependable and constant quality fuel was felt all over the country in order that output might be increased with the minimum of trouble.

With the use of this fuel it was found that many of the troubles associated with the use of liquid and solid fuels were eliminated.

During those tragic days the Gas Industry played its part well, and it did not fail in the service which it was able to render to the nation in its time of need. One important lesson was learned; that to depend on external supplies of fuel may, in time of war, lead to grave and serious consequences.

There are no oil wells in this country, and therefore we are entirely dependent upon supplies from overseas. These may be withheld or the price may be inflated to a prohibitive extent. The mere suggestion of an oil embargo has recently put one European nation in a state of panic, and has apparently upset the mental equilibrium of the rest of the world. We have been told that, in time of war, transport by sea will be a hazardous and dangerous venture, and to disregard entirely this warning cannot be in the interests of this country. That production of the essential materials for war might be arrested owing to the failure of fuel supplies should not for one instant be contemplated. It has been said that we could revert to the use of raw coal when we can no longer obtain fuel oil, but to convert existing furnaces so that coal could be used to fire them would, in all probability, prove wellnigh impossible, and the time required to make such conversion might prove disastrous. To change over to gas would certainly be a far more rational and practical procedure, but that also might be attended with serious difficulties.

Fuel technologists to-day are agreed that the direct use of raw coal in industry is wrong, and the view is generally held that coal should be subjected to some process by which its valuable constituents may be recovered and made available for use—the fuels for production of light, heat, and power, and the chemicals for the arts, science, and industry. This view is, in some measure, born of the need to conserve our coal resources. It would appear that in certain quarters this need is now considered less insistent, owing to the availability of oil. This surely is a fallacy, and it cannot be too strongly stressed that the advent of this foreign fuel has not made the matter of coal conservation one whit less urgent.

The industrial activities of this country are based on coal, and their future must depend upon the continuance of its supply. When cheap fuel fails, England will no longer be one of the great workshops of the civilized world, unless some as yet untapped source of cheap energy is discovered and made available for use in our factories and workshops.

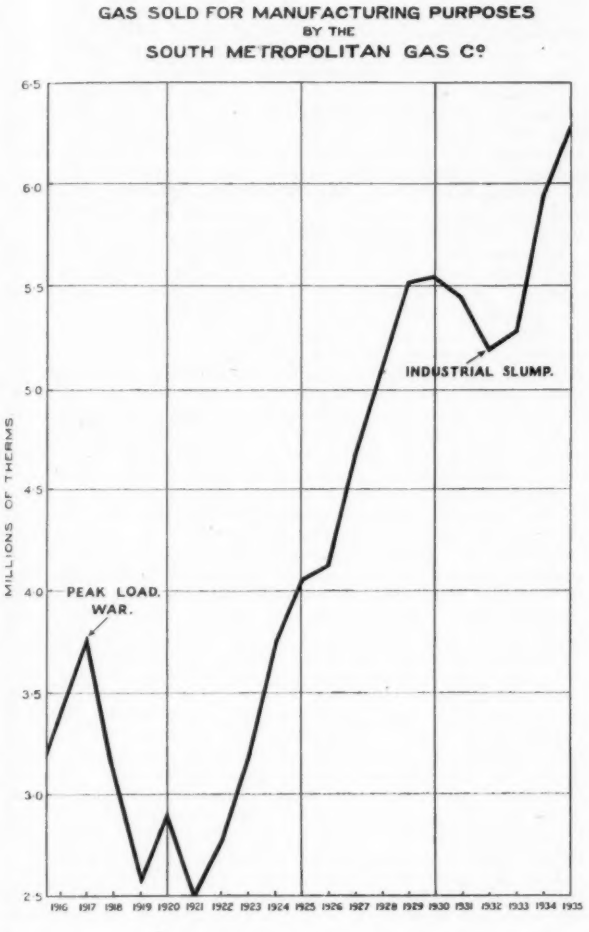
We must conserve our coal, and for that and other reasons, not raw coal, but the fuels obtained from its carbonization, are to be regarded as the national fuel.

The Lord Chancellor sits on the woolsack, for wool was at one time the life blood of the nation. In this industrial age coal is our life blood. It is surely not inappropriate to suggest that, in order to bring this fact home to the Government and to our industrialists, the Lord Chancellor should now be seated on a sack of coal or perhaps more comfortably upon a cushion inflated with town's gas.

It is instructive to consider the economics of the direct use of raw coal on the one hand and the use of the fuels produced from the carbonization of that coal on the other hand. Two examples will suffice. In the heating of metals, say a melt of 10 tons of lead, the quantity of coal required may be about 560 lb. in weight, or say 75 therms. But with gas as the fuel the work can be done with the expenditure of, say, 20 therms. This quantity of heat can be obtained by the carbonization of 600 lb. of coal at the gas-works, and there will be obtained also about 300 lb. of smokeless solid fuel and a quantity of valuable chemical substances. The coke alone would be sufficient to melt some 7 tons of lead. It is seen, therefore, that the net result of the carbonization of coal is to secure a very great gain. Again, consider the heating of steel by gas and electricity. Owing to the differences between the calorific values of the coals used in electricity generating stations and gas-works and of the coke produced by the latter the comparisons are brought out in therms rather than in pounds of fuel.

The requirement is the heating of one ton of steel to

900° C., which necessitates the absorption of slightly more than 5½ therms by the steel. Taking a thermal efficiency of 55% for the furnace, it comes out that electric heating will need a little over 10 therms at the furnace. A pretty generous allowance of 25% for the overall thermal efficiency of electricity generation and transmission will bring this up to 41 therms in the coal at the generating station. Some 17½ therms of gas would be needed with a gas-fired furnace, or roughly 70 therms in the coal at the gas-works. This



70 therms of coal would yield about 32 therms of coke, which quantity could be used to heat a further ton of steel.

In other words, 41 therms of coal will heat 1 ton of steel by electricity and 70 therms of coal will heat 2 tons of steel by gas and coke—carbonization gives 100% greater duty for a 70% greater expenditure of raw fuel, which is a clear enough saving.

From these two examples it is clear that considerable economy in the quantity of coal required results from its treatment at the gas-works. This is mainly due to the fact that gas can be burned completely without excess air and in a more confined space. Coke also can be burned more efficiently than raw coal, because it does not contain hydrocarbon constituents, which are eliminated by the thermal treatment of the coal at the gas-works.

Some few years ago an eminent engineer on the Continent said "that the gas-works should be the central station of any city or town for light, heat, and power. Economic consideration demanded that no bituminous coal should be burned for any purpose whatever, but it should be dealt with first at the gas-works."

It would appear that the logical and rational procedure is to use gas as a fuel wherever it is possible and to employ coke for the generation of steam for power.

It would be foolish to advocate this without regard to consideration of cost, for this is the crux of the problem. At a time when manufacturers were being pressed by the urgency of war, consideration of cost hardly entered into the problem, but to-day industry is on a strictly competitive basis and cost is a major consideration. We are accustomed to hear that gas is too dear. How is it then that in recent years there has been in industry a wide change over to gas? So great indeed has this movement become that many gas undertakings have recorded very considerable advance in the sale of gas for use as a fuel in factories and workshops.

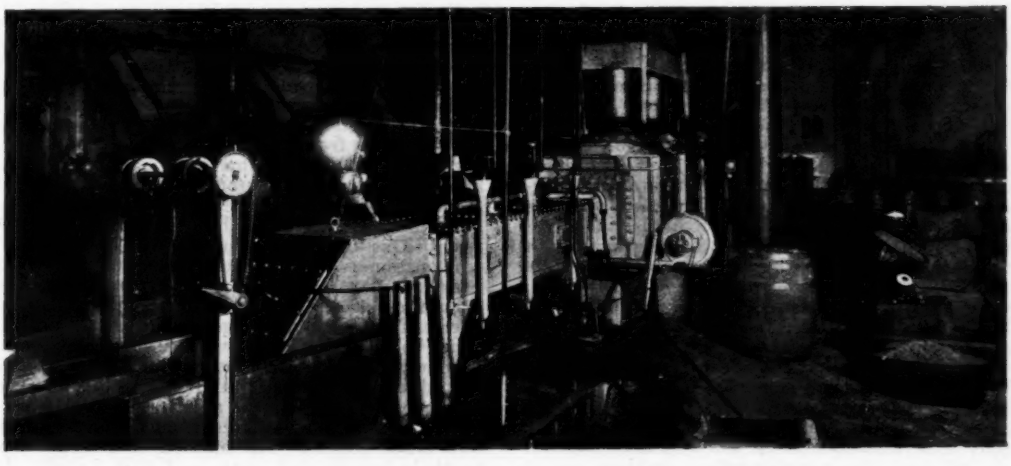
In parentheses—it is worth noting that the output of gas for industrial and commercial uses only is about equal to the output of electricity from authorized undertakings for all purposes except traction and power.

The increase in industrial gas sales is undoubtedly due to the fact that the intrinsic properties and advantages of gas justify its apparently high cost.

Gas is always on tap and has not to be stored on the premises. It is clean and constant in quality and its flexibility does not need to be emphasized. The heat of its combustion and the quality of the furnace atmosphere are easily controlled, and it is a fuel available in any quantity at all times of the day. The amount of heat required is controlled by the operation of a tap.

In this connection it is not inappropriate to cite the case of two large gas-fired tunnel kilns, specially designed for the firing of fuse and switch-gear porcelain, which were recently described in an electrical trade paper. The article stresses that the design is unusual in that no muffle is embodied, which necessitates close control of the combustion and atmosphere. The paragraph concludes "Perseverance and eighteen months of experimenting produced a system of control that secured the required conditions, and the subsequent very economical operating costs, and good products, have fully justified the system."

The cost of maintenance of gas-fired furnaces is low, and this bears an important relation to ultimate cost. This was exemplified in the case of the recent conversion from oil to gas firing of the large conveyor type furnace illustrated on this page, which is used for heat treatment of steel. The change was made necessary by the frequent failure and breakdown of the plant, and by difficulty experienced in maintaining a sufficiently close control of the temperature inside the muffle. These arresting experiences condemned the oil-fired system, and the extra cost of the gas in this instance has been fully justified. Newcastle have had corroborative experience in the conversion of a furnace for heating brass billets prior to extrusion. It was found that a gas fuel cost 50% higher than the oil fuel cost was justified by the increased thermal efficiency of gas firing alone, without allowance being made for reduced metal loss and reduced maintenance costs.



This also applies regarding the baking of bread in side-flue ovens, and one might go on enumerating other examples, as, for instance, the baking of biscuits, the boiling of sweetstuffs, and the cooking of fish. For all these processes gas is now generally employed as the fuel with complete satisfaction. In writing of the "Prospects for 1936" an authoritative writer in one of the fish trade journals states: "I am certain that the (fish) frier is going back to gas. The change-over may be slow, but I feel it is certain." Later he says: "Electricity has been kept very much in the background. There is no doubt about it being expensive. I think most firms (range-makers) have tried it at one time or another, and most of them have dropped it. Oil fuel has not proved the success it promised."

In order to obtain satisfactory results, gas must be burnt in a rational manner and suitable gas burning equipment must be used. In those cases where unsatisfactory working has been experienced, it has been found due to unsuitable gas burning equipment. Thomas Fletcher, half a century ago, laid stress on this point. He said "that gas, although a necessity to the economical carrying out of many commercial processes, is often used in the crudest and most costly way. A gas burner may be suitable for one purpose, but exceedingly wasteful for another, and error of judgment in the application of gas may lead to its condemnation."

There is at our disposal to-day a considerable range of scientifically designed gas burning equipments and the selection of the right type to be used is a matter requiring some care and consideration to ensure satisfactory results.

Consider briefly the methods for burning gas and the systems available for its control. The simplest, and for many purposes the best, way to apply the heat of the combustion of gas is the luminous flame as advocated by William Sugg. The fallacy, which still persists, that the luminous flame is "not hot enough" was long ago disproved by Lewes and Smithells, who demonstrated that platinum could be melted in it.

The usual system of burning gas is by means of a burner, which enables the proportion of the air required for the combustion of the gas to be entrained in a tube, where it mixes with the fuel prior to its combustion at the burner head. The result is a non-luminous or so-called atmospheric flame. For a great number of purposes a flame of this character is best, especially in those cases where contact with solid materials is either necessary or unavoidable. When required, the pressure of the gas can be increased by suitable mechanical means, so that a much larger proportion of "primary air" in the gas air mixture can be used. This results in greater flame concentration, with consequent higher flame temperature. The same effect is obtained when the air which is required for the combustion of the gas is supplied under pressure. This is known as the "fan air" system. This system in recent years has been developed to a degree approaching perfection.

These devices, of which there is a considerable variety, make it possible to control furnace atmospheres automatically, and they ensure the maintenance of predetermined proportions of the gas and the air. They also provide automatic compensation for variations in the gas supply pressure and for changes in furnace resistance. In those cases where accurate and delicate furnace performance is essential the value of such a system of control need not be stressed. It is now possible to ensure the maintenance of neutral, reducing, or oxidizing atmospheres. Indeed, such is the variety of control equipment available to-day that specialized training in the application of gas to industrial processes is becoming increasingly important. The industrial heat engineer has at his disposal low pressure gas burners with natural draught air, high pressure gas with natural draught air, "fan air" with low pressure gas with automatic proportioning devices which ensure a high efficiency of combustion; he can have his flame short and hard or luminous and lambent; he can almost eliminate flame in surface combustion or extend it in diffusion combustion. Experience, either his own or derived, of these types, together with an engineer's appreciation of the requirements of the process in hand, provides the industrial gas salesman or designer of industrial appliances with a real chance of supplying the customer with an installation that will give the best operating results with economy.

The Gas Industry has, or can design, the right appliances, and is rapidly getting the right gas prices, and it therefore remains to see that they are so introduced to the manufacturing community that both the Gas Industry and the manufacturers obtain the full advantage.

You will notice that I have said the Gas Industry has the appliances, and that I have not distinguished between the gas supply undertakings and the gas appliance makers. The interests of these two complementary sections are so obviously closely identified that differences of outlook are now rapidly disappearing and the spirit of co-operation is becoming steadily more vigorous. Perhaps there have been errors of judgment on both sides, but the unity in gas politics, which is crystallized in the new British Gas Federation, has a very real reflection among the humbler constituent units.

The harmonious working of the cogs is due in some measure to another innovation—the Industrial Centres with their Co-ordinating Committee. The fostering of good relations between these sections of the industry was not, admittedly, the primary purpose of these active creations, but I see in it one of the happiest features of their work. The basic idea of co-operation, exemplified in the co-partnership systems in individual gas undertakings, is being carried by the Centres into the whole Gas Industry, and the joint effort so produced should eventually, under an enlightened Fuel Resources Authority, bring the whole industrial system of the country into its ambit. There is no cogent reason why the beneficent self-interest of one fuel industry should not be the genesis of an intelligent regulation of our national fuel resources.

Leaving the visionary for the immediately practical, I would like to direct your attention to the working of these Centres. As you know, each Centre is headed by one of the larger gas undertakings, which has the facilities—both financial and in the character of its area of supply—to develop industrial business and carry out the necessary research. The undertakings in membership, on favourable terms, receive the benefits of the bigger undertaking's industrial experience. But it does not stop at that, as there is free exchange of experience by the individual Centres among themselves, both direct and through the central office. By virtue of its standing, the central office is in a position to treat with similar bodies throughout the world, and the latest developments and knowledge could thereby be made available to the smallest participating undertaking. In no circumstances, of course, are secret processes revealed, and it is noteworthy that the Gas Industry's reputation for reliability in the matter of "confidence" stands high. Where no specialized knowledge or no commercial application of such knowledge is available, the Centres can apportion among themselves the carrying out of necessary experimentation, so that one undertaking alone does not have to bear the entire burden of its cost. I would instance the case of the Sheffield undertaking, which has done most valuable work at its own expense on controlled atmospheres for gas-fired furnaces in the ferrous metallurgical industries. Various Centres are now, however, engaged in assisted experimental work on the provision of suitable atmospheres for heat treatment in the non-ferrous metallurgical field. The benefits of such work spread beyond the Gas Industry itself.

I do not propose to enumerate the usual talking points for gas in industry and commerce, as these have been often enough quoted to be indelibly engraved on the minds of the converted and to be at least lightly etched on those of the sceptical.

Before going on to examples of the application of gas in industry and commerce, I would like to mention the trade press. I do not see why this country should not now support a publication entirely devoted to industrial gas—say, a monthly. After all, the salesmen, as distinct from the works and distribution engineers, have for some years been considered, and presumably proved, worthy of their own journal, and the industrial gas salesmen, a specialist section of increasing numbers and importance, would find a paper devoted to their own branch of considerable assistance. There is an American publication of this type with which some here are no doubt acquainted, and this seems to me to work on the best lines. It is essentially entertaining and educative in its manner of describing a gas installation, as it first reviews the interesting and important technical details of the manufacturing process without particular reference to the use of gas. It mentions definite costs "before and after" wherever possible, and that is fairly frequently, as there does not seem to be the odd reticence among American manufacturers that exists here. If the manufacturer puts down a gas-fired plant, he seems to be proud of it and is willing to boast indirectly of its value. This is a psychological attitude that we in the British Gas Industry should endeavour to build up among our customers. We should persuade them that a new, gas-fired plant is not an expenditure to be deplored, but a manifestation of business acumen, which puts them far ahead of their competitors—in short, that it really is something to be proud of and a definite selling point for their product. There is no reason why, properly handled, they should be averse to obtaining a little free, co-operative publicity—they should be able to obtain reprints at favourable rates, and the articles should be reproducible in their own trade papers. The method of presentation would be to their benefit and ours, and that benefit should grow

snowball-wise. Such a publication also becomes a valuable reference book on an extensive range of trades, and gives the intelligent salesman a good basis for his own observations. Finally, it can help the ordinary salesman (I hope the description will not pain him) to appreciate the enormous possibilities for the application of gas in industry and commerce, and perhaps make it possible for him to introduce useful leads to his specialist confrère. The examples which I give later will serve to illustrate the wide applicability of gas—at one end of the scale it is successfully adapted to give a pin-point flame for glass working or fine soldering in the jewellery industries and at the other end of the scale it provides all the heat requirements of a recently described 20-ton rolling mill.

A final word. The industrial business will not come to us. We must with diligence seek it where it is to be found. To this end men with special training are needed and they must have a combination of qualities not generally possessed by the usual type of commercial man. Selling gas for fuel in industry requires some knowledge of the varied operations and processes in which it is engaged and such information can only be obtained by special training. There is no royal road to its attainment. To assume that a few weeks in an industrial laboratory will furnish a recruit from the ordinary commercial staff with the requisite basis of knowledge is to display a lamentably inadequate grasp of the problem. There must be a more enlightened appreciation of the essential requirements of present-day conditions; otherwise the industrial business will be lost. To blink the fact that the Gas Industry has in the past proceeded along such lines is to indulge an ostrich-like disposition.

The Gas Industry must realize that its progress in the future depends upon taking every advantage of the enormous possibilities which exist for the use of gas as a fuel. It will not be worthy of its origin or its aim if it does not put forward all its energy to safeguard its legitimate birthright, which is to provide the nation with cheap, clean, and reliable fuel. It has the means; it has the men; it must supply the need or be content to renounce its heritage.

[The remainder of the Paper consists of a series of excellent illustrations, with brief description, of modern gas equipment for many industrial and commercial purposes.]

Discussion.

The CHAIRMAN (Colonel W. M. Carr) said the Address had been not only illuminating but extraordinarily useful at the present juncture. When he came there that morning someone said that Mr. Chandler would be speaking to the converted. He did not think it could be said, however, that they were all converted. Mr. Chandler had indicated that the work of the Industrial Development Centres could not, and must not, be considered in any light as a substitute for their own efforts, or that that work was going to obtain the business for them without they themselves building up the machinery in their own undertakings forming contacts and creating that confidence which was so essential to the obtaining of industrial loads. Working as he had done for many years in an industrial area he could give an estimate of the period that was necessary in order to build up confidence with the manufacturer. He would say practically one generation, or not less than ten years. He said that from a very definite experience. He had been working with hope for a longer period than ten years and it was only during the last two years that the real benefit had begun to accrue. That was happening not with new trades but with old ones that had been on their doorstep during the whole period of 10 years. He thought, therefore, it could justly be said that the first essential was to obtain confidence. Mr. Chandler had referred to gas prices. He would like to say that, whatever the price might be, in selling gas to the industrialist they must be able to sell it in terms of work output. They had to find out in every case and assess accurately the costs of a particular process upon which a manufacturer might be using other fuels. They had to satisfy themselves perhaps by preliminary experimentation as to what was the most economic proposition that they could put forward and then they must sell that proposition to the manufacturer in the terms of the unit of work. He would say "What is my cost per pound of unit output, what is my cost per ton of load?" There was one other factor which was a very important sales point and one he would like to stress. That was that they had got to be able to show the manufacturer where they could improve his process and increase his output, and get him to give them credit for that because in the majority of cases the most mobile, the most portable, and the most easily controlled fuel could almost invariably give increase in output, a better control of the process, and make a saving in the wastage of material. All these factors their industrial salesmen must have at their finger tips and be able to put them up to the manufacturer.

He hoped all the undertakings would realize the vital importance of supporting the industrial development centres in the various areas. Sometimes they found a person who said "wait and see what the development is before deciding whether or not to give support, we can get all the information we desire from the Technical Press and manufacturers." But undertakings and manufacturers of appliances had all accumulated information and it was only by the co-ordination of the industrial development centres that that was going to be readily available. They must not expect to write to Grosvenor Gardens and say "Here is a problem, what price must I quote and what plant must I put in," and then expect a reply by return of post. The industrial centres must themselves make the necessary investigation, and sometimes they would have to have a consultation not only with the gas undertaking but with the manufacturer to ensure that that information was correct.

He would like to stress another point. They must never claim more than they could do. They should always play for safety and have a little bit on the safe side in putting forward proposals. If they had a little in hand they could go along and say "Well, I've done better than I said I would." He believed that as time went on, in another five years, if they gave the right service to the public, they would not, in industrial areas, be talking about something like 30% but many of them would be talking of 50% and 60%. It was no illusion. The industrial load was there to be obtained if they built up the machinery and made the utmost use of the machinery which had been set up by the industrial development centres and being co-ordinated through the national bodies and through the British Gas Federation.

Insufficient Collaboration.

Mr. J. FALLON (Managing Director, Incandescent Heating Company) said one remark by the Chairman seemed to indicate that the Gas Industry was at last acquiring some sense of proportion. He referred to applications to Grosvenor Gardens for information by return of post. He could only say that gas undertakings rang them up by telephone and asked for an answer right away [laughter] and sometimes they were complex matters that their own research department had not been able to solve. He represented an industrial furnace combine that was probably the largest in Europe and he felt very often the high regard for secrecy was too heavily maintained, that there was not the full, free, and frank collaboration on development work there might be although he must pay tribute to the gas undertakings for the work they did in collaboration with manufacturers. While electricity had made great claims in regard to the treatment of low-temperature metals he believed that one of the largest orders placed in the industry recently for low-temperature treatment for polished work had been won over to gas. The interests he represented built every type of industrial furnace and they had not the slightest hesitation in the bulk of cases in advising, quite impartially in the interests of the customer, that gas was the best fuel. In 1914 the percentage of gas furnaces built by the Industry was in the order of 7%; to-day in a business twenty times the size the percentage of gas furnaces in relation to the total built was 46½%. He thought that was a very satisfactory showing and indicated that the industrial furnace people were collaborating with the Gas Industry. These figures meant more than that. He only spoke for one interest but the number of gas furnaces built had meant an addition to the load of half-a-million cubic feet per hour, that was over 12 million therms per annum. That provided a very good case for collaboration with furnace undertakings. Another strong point he would make was that many gas undertakings to-day were inventing and re-inventing appliances knowing furnace manufacturers were doing the same thing. Sometimes the furnace manufacturer who helped and collaborated with the industrial research centres found himself in a position where he could not readily open his soul to a partial competitor. That was the actual state of affairs in many parts of the country and one which should be remedied. They should all have faith in the Gas Industry and have a little faith in the furnace manufacturer, and then he thought the Gas Industry would go from strength to strength. As he had pointed out, one furnace interest alone had contributed more in the terms of therms than the industrial loads of certain large gas undertakings. They had great faith in gas and believed it was the logical fuel from the furnace builders' point of view.

Dr. C. M. WALTER (Birmingham) said the Paper not only gave them food for thought immediately, but it would be a fine work of reference, because it brought up to date a lot of appliances which some of them had little opportunity of putting into practice. He felt that Mr. Chandler had given them valuable information in regard to methods of selling industrial gas, because they all knew, as he said, that the business would not come to them. They had to go out and get it, and it was a difficult business to obtain in some respects, particularly in regard to manufacturers who had had no experience and could not assess for themselves the huge advantage to be derived from the substitution of town gas. The difficulties were generally due to the fact that the cost advantages were so obscure. They had to go into the question of costs and in some instances they had to verify production costs right through from the raw material before they could convince a manufacturer. He thought they would all appreciate, in connection with the use of town gas as an industrial fuel, that they must not expect the manufacturer himself to realize a lot of the advantages of which they in the Industry knew only too well, especially when he had not had an opportunity of finding out how the use of town gas affected his all-in cost. They were apt to judge purely on the fuel cost basis. They must go out and make a full assessment of costs. He did not think they could do it by correspondence; they had to visit the manufacturer and get in personal contact with him. In Birmingham they had made a particular point of making themselves conversant with the processes with which gas could be used, and almost secondary the

matter of the supply of gas. If they did not understand a manufacturing process they could not talk to the manufacturer.

Air Heaters.

Another important point was the use of air heaters. Many of them had not applied air heaters to the extent he felt they should apply them in the future. In Birmingham they had done a lot of work in connection with air heaters for dehydrogenation purposes and low-temperature operations, such as aluminium ageing and the tempering of springs and on other classes of steel work. He felt that there was an enormous field to be covered by the use of such forms of apparatus in preference to the old type where they subjected the material to the products of the combustion of gas. He quite agreed they could not get this work done in five months. They could not give the manufacturers a so-called book of words to follow, they must have experience. He could confirm the Chairman when he said they would not reap the fruits of their labours for some few years. He could say definitely now they were receiving enquiries as the result of work and demonstrations they gave at the B.I.F. many years ago. Manufacturers were gradually becoming gas-minded, but they had to keep hammering away and show the advantages of gas, particularly how the manufacturer could improve his product and reduce the all-in cost.

Dr. A. FELLS (Sheffield) said contributions that morning had been more or less confined to costing and the use of gas as a heating agent. He would like to draw attention to another field of industrial use of gas which in his opinion was going to become much larger in the future. He referred to the atmosphere control of metal treatment furnaces. They might have noticed that in the last five or six years the electrical industries had made tremendous strides in applying gas to the electrically heated chamber. The electrical industry had tried more than the Gas Industry to put atmosphere control to good industrial use but they had tried any gas rather than town gas. The Gas Industry ought to have that matter at its fingers' tips. He did not think there was any atmosphere control process in metal heat treatment which could not be done with town gas prepared in a suitable manner. The non-ferrous metal treatment industry was also coming along and there was no reason why the Gas Industry should not get the bright annealing load and replace that done by electricity. He would like to urge close collaboration between the furnace makers and the Gas Industry. Some firms carried out their own research work and brought out excellent furnaces, but he suggested closer collaboration than there had been between furnace makers and the gas departments.

Vote of Thanks.

Sir FRANCIS GOODENOUGH, C.B.E., proposed a hearty vote of thanks to Mr. Dean Chandler for his Paper. They had been blessed by having a specialist reader of the Paper, a specialist chairman, and specialist speakers in the discussion; he himself was not a specialist, said Sir Francis, but he wanted to voice the thanks of the meeting to Mr. Dean Chandler and their Chairman for the valuable contributions they had received that day from both of them. This Paper was not going to be the least valuable work of reference, and the discussion which had taken place would be of real benefit to the Industry. The Chairman had said that it was preaching to the converted; but many of them would go away converted as to the potentialities of the industrial load in a way never before achieved. There was an enormous load to be obtained on the industrial side, particularly if they studied the matter from the user's point of view. This was what they had to learn in salesmanship—both domestic and industrial—so as to establish that confidence which took years to develop and constant vigilance to maintain.

Sir Francis went on to emphasize that they must not exaggerate their claims. Many years ago he had put the claims of gas to displace electricity before a railway engineer, who had said that if half the claims were justified he would be more than happy. An advantage of £900 per annum was promised for gas—and at the end of the year £1,100 had been saved. If one claimed more than it was possible subsequently to achieve one had dissatisfaction; but if one claimed a little less than one was likely to achieve, and then achieved a little more, one made a friend of one's customer. That was one of the essential precepts of salesmanship. It might take years to gain the confidence of one's customers; but it did not take ten seconds to destroy it.

One of the finest ways of obtaining the industrial load was to take a census of the district in order to see where one could save consumption for the consumer. By starting out to do this they would be gaining the interest and confidence of the customer as no other method could. Sir Francis endorsed what the Chairman had said in regard to co-operation with the Industrial Centres; if advantage did not result at once, it would certainly follow later. Such co-operation meant that each undertaking must play its part first—and results would come in due course. Two hundred and fifty undertakings started by supporting the British Commercial Gas Association—and now they had eight hundred to support it. In conclusion, Sir Francis expressed pleasure that Col. Woodall was present on that occasion; he had been one of the first supporters of the B.C.G.A.

A Difficult Load.

Mr. RALPH HALKETT (Sheffield) said that it gave him great pleasure to second the vote of thanks to Mr. Dean Chandler for his able Paper. He was sure they would all find it most instructive, and when they had had time to read it through carefully they would all benefit from it. The industrial load, he observed, was rather a difficult one to obtain at the commencement. They must attack their potential consumers on the lines of the suitability of gas in the first instance—and they must not be disappointed to be turned down several times before getting into the premises. They were now reaping the benefit of the work they had done during the past four years. If industrialists were going to change over to another class of fuel, involving some considerable outlay, they must be convinced that it was warranted. One of their own consumers had changed over from solid fuel at a cost of £54,000; and business men must give matters of this kind much consideration before making the change and be quite sure that it would be a paying proposition. They must not be disappointed if they did not get every consumer immediately they approached them.

There had been some reference, continued Mr. Halkett, to training for industrial departments. It took years to train the men engaged in this work. They had in Sheffield men of long standing and with years of experience spent in making themselves thoroughly conversant with the operations undertaken by industrial consumers. It was their practice to make themselves as familiar with the work as those who were actually doing it. They were going forward by leaps and bounds; they had over 11% increase in consumption—and this following a 12% increase the previous year. So that once their consumers were convinced that gas was the fuel, they would go ahead, and Mr. Halkett was confident that there was no town in the country where gas could not be utilized for industrial purposes in one form or another. They were indebted to Mr. Dean Chandler for his very able Paper, and he was sure that the whole Industry would benefit by it.

Publicity Value of Glass-Blowing Exhibit.

Mr. H. R. HEMS (Birmingham), in supporting the vote of thanks, remarked that those who worked with Mr. Dean Chandler on the Industrial Centres Committee knew what a tower of strength he was, with his vast experience extending over a large number of years in all branches of the industrial application of gas. He felt that he would not like that meeting to close without particular reference to the fact that Mr. Dean Chandler was the designer of the glass-blowing furnace on the B.G.F. Industrial Exhibit, which he thought could be claimed to have created a sensation. He had been insistent in their earlier deliberations on the question of the Industrial Exhibit and had won them over to the great possibilities of its advertising value. There was no doubt that from the time the Fair had opened, when the stand holders had started the crowd, that crowd had been going on ever since. That furnace had put gas into the Press and " on the air " in a way that had not been done before.

Closing with a reference to the Industrial Exhibit, it had been Mr. Hems' privilege to watch a number of enquiries, and he thought the Industry, and especially those associated with the industrial side, must begin to feel more optimistic about the great possibilities for the future. These possibilities had been mentioned on that occasion by those connected with the industrial and supply sides, and he was only too pleased to say that the number of enquiries received from all classes of undertakings indicated that the manufacturer was definitely becoming gas-minded. In one instance a manufacturer came to enquire about a particular process, and before Mr. Hems could say a word about the advantages of gas for the purpose the manufacturer simply stated that he was going to use gas in any case for the process. He was obtaining his gas from a small undertaking, and evidently there had been some discussion on the question of costs; so he had come to the Industrial Section with a view to obtaining some information in regard to his own ideas of carrying out the process by gas.

The CHAIRMAN said that he would like, before asking Mr. Dean Chandler to reply to the vote of thanks, to say that while the discussion had been on the lines of the larger issues and the major undertakings, he did suggest that there was no town or hamlet in the country where there were not the possibilities of commercial or industrial uses for gas. They were apt to say that there was no possibility of an industrial load in a certain place; but there were shops and bakeries which were commercial applications that required investigation in regard to gas usage. He would not like that meeting to break up thinking that all the research work was being done by electrical appliance manufacturers. The Gas Industry had had problems on which they had been working very hard during the past few years, and this matter was receiving the most careful consideration of the Joint Industrial Gas Committee at the present time; they were not leaving this work entirely to their electrical competitors.

Mr. DEAN CHANDLER acknowledged the vote of thanks and expressed his appreciation of the way in which they had received his Paper. It had given him much pleasure to prepare it. In regard to the gas salesman telling the truth, this applied in every sphere of life; but the only way to obtain the industrial load of the future was to be absolutely truthful in their claims for gas. It was no use trying to play too high.

A Successful Conference.

Col. H. W. WOODALL finally proposed a hearty vote of thanks to the Joint Gas Conference Committee and to Mr. H. C. Smith, its Chairman. Very few words of his were necessary in view of the great success which had attended the Conference. Anything with which Mr. Smith was connected, observed Col. Woodall, was successful, and he would also like to commend

Mr. J. C. Walker for the part he had played. They knew how greatly the success of the Gas Industries Section was bound up with the Conference; if it were not for the Conference they would not see so large a number of representatives of the Industry gathered at the Fair.

Mr. H. C. Smith (Tottenham), as Chairman of the Joint Gas Conference Committee, acknowledged the vote of thanks, and on behalf of the Committee he remarked how delighted they were to have the task of organizing the Conference again at the British Industries Fair. Their last Conference was in 1934, and then they went into "cold storage" for a year—and it said something for the efficiency of gas refrigeration, observed Mr. Smith amid laughter, that they had come out again in such a perfect state of health! He thought that their Conference this year constituted a record, and it was very appropriate that the re-birth of the Joint Gas Conference Committee should be under the ægis of the British Gas Federation, because until the Federation was formed the Joint Gas Conference Committee was the only association of all the bodies which now constituted the Federation. In acknowledging this vote of thanks, Mr. Smith referred especially to the work of Mr. Walker, who was the man who did most of the work, and during his absence in Scotland his work had been carried on by Mr. Elson, to whom they were also indebted.

Official Gas Industry Luncheon

At the British Industries Fair

The EARL OF DUDLEY presided at the official luncheon held in the Bradford Room following the first session of the Conference on the Tuesday.

Capt. Euan Wallace, M.P., Secretary to the Department of Overseas Trade, in proposing the toast of "The Gas Industry," said the Industry's exhibits could well be described as an illuminating example of skilful showmanship, and for size it constituted a record. The base upon which these exhibits rested was sufficiently solid and substantial, for the Gas Industry was the sixth largest national industry, employing 126,000 men. With what might fairly be called its allied industries it found work for 4% of the insured male population. Perhaps the most impressive feature of the Gas Industry to a layman was the ability and resolution with which it faced the competition of a newer and, at that time at any rate apparently, more convenient form of illumination. The success with which it did so was shown in the position it held to-day.

He did not know whether the gas and electrical industries regarded each other as complementary or competitive; at any rate the motto of Birmingham was well exemplified in both its gas and electricity undertakings. Friendly rivalry was good for the consumer, private or industrial. The Gas Industry had always been well to the fore in research, upon which all steady progress and efficiency depended.

By the end of this week it was estimated that his own Department would have spent £21,000 in the last three years on heating equipment and consumption of gas at the British Industries Fair in London.

There was every reason to anticipate that the Gas Industry would make new records in 1936. The consumption of gas inevitably rose as the general standard of living improved. Since the war the total output of gas had increased by nearly 50%. It was notable that this increase should have occurred in a period of rapid change and reconstruction, of new standards of value, and of keen competition. More than 90% of the houses and flats built in the last decade were serviced for gas.

The progress of gas marked a new stage in the liberation of women. Automatic control, new designs, and finishes were common features of the gas appliances on show at the Fair. Gas refrigerators and water heaters were entirely automatic, gas cookers had automatic oven control, and gas fires lit themselves.

The Earl of Dudley, in responding, spoke of the satisfaction that the appointment of Capt. Euan Wallace had caused throughout British industry and particularly in Birmingham, where industrialists were quick to recognize a man of real ability. He was sorry to have been prevented by illness from attending the Federation Banquet last autumn but he would like to assure them that he was very proud to have received an invitation to occupy that honourable position particularly during a year when the Gas Industry had made such enormous strides.

Proper Treatment of Raw Materials.

As a coal owner he recognized that the future of the trade, and indeed the future prosperity of the country, lay in the proper treatment of their raw material. Of all the processes that had been examined in recent years the carbonization of coal at the gas-works was still the best treatment and extracted the greatest number of saleable by-products. He wanted to end on a note of optimism and to say that he thought the prospects of the Gas Industry were never brighter than to-day. He was very proud to be President of that Federation because it had such fine leaders and fine members who were keenly alive to their great national responsibilities and had combined together in a determination to make the Federation the mouthpiece of their national policy.

"I am afraid," he said, "I have been a lax President owing to ill-health, but I have still some time left and I am going to make up for lost time."

Sir David Milne-Watson in proposing the toast of "The Guests" said all of those who were connected with the Gas Industry realized they were fortunate in securing such an excellent head for the Federation as the Earl of Dudley. It was most satisfactory to find that under his Presidency the Federation had for the first time undertaken the work of ensuring that the Industry was worthily represented at the Fair. The gas exhibit reflected the greatest credit upon the Gas Industries Section Committee which represented not only all the standing bodies composing the Federation but also the City of Birmingham Gas Department and the Birmingham Chamber of Commerce.

Birmingham was known as a model city and in no respect was that more so than in regard to its Gas Department. Not only did the Gas Department provide a service both for domestic and industrial purposes which was second to none in the country, but they realized the national importance of the Industry and did all in their power to further the efforts of the national bodies. They would be the first to admit that much of their success was due to the General Manager, Mr. A. W. Smith, and his excellent staff. He was wise in counsel and instant in service, and he was always ready to impart the fruits of his knowledge and experience to others. Another official of the department who had rendered great service to the Industry was Dr. C. M. Walter. His name, along with that of Mr. Smith, would always be closely associated with the inauguration and successful working of the Development Centres which were now in operation throughout the country and had done much to develop the use of gas for industrial purposes. They also welcomed with great pleasure the distinguished representatives of the Department of Overseas Trade. Their presence provided a clear indication of the great importance the Government attached to the Fair. He also welcomed, as he was sure everyone else did, the presence of representatives from the National Joint Industrial Council. The Council had been in existence for 16 years and had undoubtedly been of the utmost utility and service in ensuring cordial relations between employers and employed and between gas undertakings and trades unions catering for gas workers. "We have always said and I have never heard it disputed," he added, "that our National Joint Industrial Council is a model among the joint industrial councils of this country."

Indicative of Progress.

No doubt the Gas Industry might be tempted to regard the Fair as a background for the gas exhibit, but they were fully conscious that it was a magnificent background and their hearts glowed with pride that despite the difficulties which still beset trade and industry our manufacturers could stage such an incomparable Fair everywhere indicative of skill and progress. He hoped and believed that this progress would be maintained and accelerated.

"I do see, however, a shadow coming over the picture," he said. "I refer to the coal position. If the Government proposes to pursue what I understand to be its policy of setting up in each district an unregulated and uncontrolled monopoly without any protection, or at any rate without any adequate protection for consumers, the price of coal will undoubtedly soar, costs of manufacture will increase, and the rate of progress must inevitably be slowed down. Apart from its materialistic considerations the policy is un-English. It was opposed to every tradition in the history of the country and offended all sense of equity and justice."

Sir Reginald Clarry, M.P., in responding, said he did not think the public fully realized the grave dangers from a national point of view of centralized electricity and mass distribution. There was the financial danger that the Central Electricity Board, with apparently unlimited money at its disposal, might lead the country with its commitments as to the future into a situation that would fall as a liability on taxpayers unless matters were carefully handled. The other danger was more spectacular. That was our vulnerability in times of war or trade dispute when with comparative ease a

whole area could be blacked out and essential industries affected and this country temporarily demoralized. That to him was a grave danger in our system of defence. The Gas Industry had been of very vital service to this country both in the time of war and of peace. It was a curious anomaly that it should not be permitted to have free rein of competition with its rivals and should still suffer from the shackles of obsolete legislation. He could see even greater possibilities for the Gas Industry in the future, for he understood that a certain process had gone beyond the experimental stage, that motor spirit could be made under conditions which were competitive from water gas and hydrogen, and that Diesel oil and lubricating oil of high quality could be produced. Economists had been looking forward for some years to finding some means of producing from our coal resources that liquid fuel which it cost so much to import. Thus there was a magnificent vista opened up for the Gas Industry if from our resources of coal they could produce gaseous and liquid fuel and other products.

Guests of the Birmingham Chamber of Commerce And the Fair Management Committee

At the conclusion of Wednesday's session of the Joint Gas Conference, the delegates were the guests of the Birmingham Chamber of Commerce and the Fair Management Committee at luncheon—Mr. Percy Plant (Chairman of the latter body) presiding.

The Loyal Toast having been honoured,

Mr. PERCY PLANT said that on behalf of the Birmingham Chamber of Commerce and the Fair Management Committee it gave him great pleasure to give them a warm and sincere welcome to this Section of the British Industries Fair. It was his privilege to propose the toast of "The Gas Industry," and he had pleasure in coupling with that toast the name of Col. Carr, who they were very pleased to have with them that day. Col. Carr, he observed, was President of The Institution of Gas Engineers and had done excellent service to the Industry in his work on the various research sub-committees of the Institution, and he was reminded that he had previously addressed the Joint Gas Conference in that place on the subject of industrial gas. He thought the Gas Industry was to be complimented on the research work that had been carried out in all branches, which, as was well-known, ranged from investigation into refractory materials to the smallest domestic appliances. He was told that this was the first time that the Joint Gas Conference had been organized under the ægis of the British Gas Federation and that the number of delegates constituted a record.

It was particularly pleasing to welcome the Gas Industry on this occasion, because they were not with them last year. The previous year they had held the Birmingham Section of the Fair in May; it was somewhat of an experiment, and after having gone through with that experiment—and he was very glad they had made it and would not have gone without it for anything—they were definitely satisfied that later in the year was not the proper time to hold this National Fair. But, most important of all, he thought it had been definitely proved to the satisfaction of them all that it was useless, and certainly not in the best interests, to hold this Fair in Birmingham at a different time from that in London. In the future, therefore, all sections of the Fair would be held at one and the same time. There was a school of thought which held that they got more overseas buyers later in the year; but this was incorrect. If at any time in the future it was possible for the London Sections to be a week or so later, they would give it very careful consideration; but for the time being they were definitely fixed for one time for all Sections.

The Gas Section had staged a wonderful display on this occasion. It occupied a total floor space of 32,000 sq.ft., and he believed that when the Gas Section was first organized in 1928 it only occupied 11,000 sq.ft.—which was an indication of the great progress which had been made. The Gas Industry was one of the oldest industries, and he was proud to say that at the present time it was one of the most virile. He hoped that next year the exhibits of furnace manufacturers would be more in evidence, because the furnaces there this year were very wonderful and certainly among the most popular exhibits. He had had the privilege of taking many distinguished visitors round the Fair each day, and their particular interest in these exhibits made his suggestion well worth consideration.

They did not like to refer to the British Industries Fair in the ordinary way as an exhibition. They preferred to regard it as an epitome of everything that was best in British industry as applicable to modern trade both at home and overseas; and because of this view they had received representatives and buyers from more than sixty different countries, who had come there because of the business facilities provided. It was the finest advertisement for British engineering.

Once more he extended to them a very hearty welcome and had great pleasure in proposing the toast of "The Gas Industry," coupled with the name of Col. Carr.

In the Forefront of Progress.

Col. W. M. CARR, in replying to the toast, remarked that as President for this year of The Institution of Gas Engineers, there had been no occasion—nor would there be an occasion—on which he would reply to this toast with greater pleasure, because he did feel that their fitting participation in this great Fair was an indication to the whole of the country and beyond to countries overseas that the Gas Industry, at any rate so far as Great Britain was concerned, was not one whit behind any other industry—but rather in front—in regard to the progress it had made. Their Conference was one of 66 associations attending official luncheons in the fourteen days of the Fair. The organization which had had to be set up to cope with such a number of visitors was almost beyond the conception of the layman, and he would like to say how much they congratulated the Management Committee and the Birmingham Chamber of Commerce, in conjunction with the Government department involved, on the organization of this wonderful Fair.

The Gas Industry, of course, were proud of their participation. He thought the fact that a year ago they had decided that May would be an unsuitable time to them and had stayed away, had been not only a good thing for the Fair but also for the Gas Industry. They had had time to weigh up and consider, and they were immensely proud of the work which had been done by manufacturers in the meantime.

Col. Carr referred to the work of the Joint Committee and the Birmingham Gas Department in the preparation of the Industrial Exhibit. Everybody would agree that it was far in advance of anything they had previously been able to show. But fine exhibit as it was, it was, of course, no indication of the vast work which they as an Industry were doing for manufacturers generally. It was, for instance, impossible to show the very large plant which was being put down in steel works and for other large operations; exhibition space would not permit of this. But the Industrial Exhibit as it stood gave a better perception than ever before of the ever-extending uses to which gas was being put in industry. There was a publication by the B.C.G.A. entitled "One-Thousand-and-One Uses for Gas;" he thought, however, that "Ten-Thousand-and-One Uses for Gas" would be nearer the figure to-day. It was interesting—and should be appreciated by the public of this country—that there was hardly an industry of any kind which was not using gas to-day for one purpose or another. Indeed, manufacturers who years ago were not looked upon as being potential consumers were now glad to avail themselves of the clean, convenient, adaptable, and easily controlled fuel which they were able to supply. They had in the Gas Industry not only efficient workers on the manufacture and supply sides, but they had equally efficient and highly scientific workers who were engaged in improving the appliances and apparatus utilized for the burning of gas as a fuel. So great had that improvement been that the efficiency of domestic appliances in use to-day was 33⅓% better than it was ten or fifteen years ago; and therefore, not only were the public getting generally cheaper gas to-day than before, but they were getting a saving of 33⅓% in the approved appliances for its use. He had said in his opening remarks that this exhibit would be seen far beyond the confines of this country, and he believed that they had with them that day M. Louis, of the Paris Gas Company, representing the French Gas Industry; he hoped he would take back with him some encouragement from what the Industry had been able to show at this Fair, and would return with a feeling of renewed energy—if he required it—and renewed strength in the future outlook of their Industry.

Of Educational Value.

They had had their Junior Associations at the Fair. This Fair afforded not only the opportunity for the senior officials of gas undertakings to see what was new; but they were in increasing numbers taking advantage of it to send their junior staffs with a view to getting them up-to-date. He hoped this policy would extend and that they would send to the Fair for educational and instruction purposes as many of their employees as they could possibly spare, because apart from its trading value to them as an Industry, the Fair had an educational value which was not one of its least merits.

In conclusion, Col. Carr thanked Mr. Plant and his Com-

mittee for their co-operation and assistance in regard to the Conference they had just held. They hoped that during the next twelve months they would show even greater advance than they had shown this year as compared with two years ago. They would leave Birmingham at the conclusion of the Fair feeling that good work had been done for the British Gas Industry, and even better work for the whole industry of the country, by their exhibits in the Gas Section.

Councillor WALTER MUTER (President of the B.C.G.A.) said that a very pleasant duty had been entrusted to him. He had been asked to convey their sincere thanks to Mr. Plant, not only for his occupancy of the chair, but also for his abounding hospitality. No one could visit this marvellous Fair without being struck by the resilience of the British manufacturer. From the financial crisis of 1931, when the whole of the country was afflicted with a degree of gloom which was fortunately only temporary, the British manufacturer and all those associated with him had risen up, proud to belong to the largest exporting nation. That was in a great degree due to the perseverance, enterprise, and enthusiasm of the people who originated this Fair twenty-one years ago. While they must buy British, said Councillor Muter, they must also *sell* British. Manufacturers were having brought home to them day by day the necessity for extending and enlarging their overseas trade. He asked them to drink the health of their Chairman, Mr. Plant.

Mr. PLANT, in acknowledgment, expressed his appreciation of the kind way in which they had received this toast. The Fair Management Committee was the governing body; but they had some excellent sub-committees. This year the Fair had run itself more than ever he could remember before. It had run very smoothly, and he was indebted to his colleagues for the assistance they had given him.

The remaining period of the Conference was devoted to further inspection of the exhibits.

Demand for British Motor Spirit

The National Benzole Company's Programme

To cope with the increasing demand from motorists for home-produced motor spirit the National Benzole Company are opening new depôts and extending existing depôts in many parts of the country. New depôts are under construction at Ipswich, St. Albans, and East Greenwich, and extensions will be made to existing depôts at Leeds, Preston, Nottingham, Peterborough, and Sunderland.

These developments by the National Benzole Company will necessitate additional rail tanks and road tank wagons, as well as the equipment for the depôts. All the material used will be British throughout.

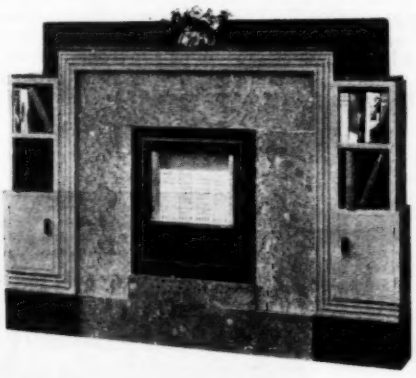
"Portcullis" Publicity

Attractive Brochure by Bratt Colbran, Ltd.

Though comparative newcomers to the Gas Industry, Bratt Colbran, Ltd., have set a standard in their publicity work which has attracted favourable comment in all quarters. Their latest catalogue (List No. 4, Fires and Surrounds) is a magnificent production, setting forth all their gas fire models in the most beautiful surrounds and printed throughout in actual colours.

The firm have set out not merely to manufacture an independent gas heating unit, but rather to provide a permanent heating medium in one composite whole, suitable for the most exacting style of decoration; and a perusal of the pages of this brochure brings home more and more that past prejudices in this respect must soon be overcome when the discerning architect can be persuaded to consider some of the beautiful settings which can be provided in conjunction with a modern gas fire.

In this List details of the various "Portcullis" models are fully given, while, in addition, an attempt has been made to illustrate a much wider range of surrounds and settings in marbles, tiles, &c., which have all been designed in strict keeping with the architectural character of the fires. There is no need to refer here again to the particulars of the fires themselves, which are doubtless by now familiar to our readers, and which are specified in detail in a separate List. Suffice it to say that the settings as a whole, comprising many styles of woods, marbles, and tiles, and embodying in some instances bookshelves and cupboards, combine to provide fireplaces which must break down the prejudice of the most exacting of critics.



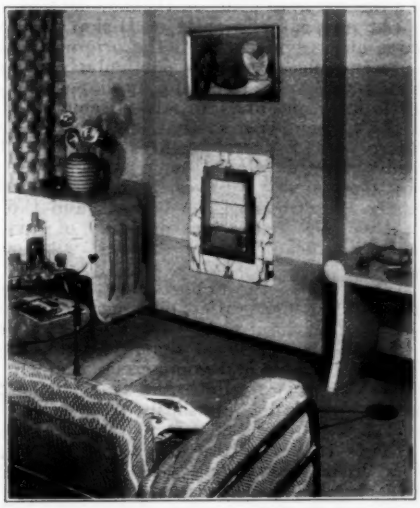
A Beautiful "Portello" Setting Embodying a Mantel in Pine with Bookshelves and Cupboards.

The "Portcullis" self-lighting unit is described at the end of the brochure, together with the firm's convector heater and portable models, while a colour chart of the various attractive finishes and marbles suitable for surrounds completes a very noteworthy production, whose salient feature is undoubtedly the excellent natural colour printing which so effectively illustrates just how the "Portcullis" fire will look when installed in the home.

Panel Gas Fires

A New Publication by R. & A. Main

A brochure devoted exclusively to the built-in treatment of gas fires strikes a new note in the Industry, and Messrs. R. & A. Main, Ltd., are to be congratulated upon the production of their latest catalogue, which deals with the increased facilities provided by panel gas fires for modern decorative treatment of fireplaces.



A "Panamain" Fire in an Attractive Setting.

The beautiful illustrations in actual colours show a wide variety of attractive settings, whereby the application of panel gas fires greatly enhances the appearance of the fireplace. In all but two of the designs included the fires can be fitted at any height from the floor level, and thus made to conform to whatever proportion may be desired, while the flat planes, shallow fenders, and the absence of protruding canopies ensure minimum projection into the room space.

Among the many pleasing fireplaces suggested are those including the "Panamain," the "Starmain," the "Plaquette," and the well-known "Gloria"—all portrayed in different attractive settings designed to harmonize with various decoration schemes—while the "Crichton" fire, with its novel curved radiants, provides an example of the floor-level built-in setting. A range of the colour finishes available is also included in this catalogue, which should be particularly useful for distribution to architects and builders.

LONG SERVICE
TO THE
GAS INDUSTRY

A number of firms of long standing on the contracting and manufacturing side of the Industry have collaborated with the "JOURNAL" in the production of a series of articles, under the above title.

R. & A. Main, Ltd.

Although it had been in existence—first in the early seventies as the Argyle Ironmongery Company, and from about 1878 to 1884 as Waddell & Main—the firm of R. & A. Main, Ltd., apparently did not advertise in the then "JOURNAL OF GAS LIGHTING" until 1881. Its advertisement was at that time concerned with "Hislop's Metallic Gas-Fire," which had been invented by the Gas Engineer of that name at Paisley.

It is extremely difficult to trace the early history and development of what are now well-known firms. Which branch of the gas appliance industry did they first tackle, and what caused the dropping of effort in one direction in favour of something else? Problems like these, which to one type of mind are extremely interesting, seem in most cases to be incapable of solution through lack of surviving evidence. At any rate, in spite of Hislop's metallic gas-fire, there is other evidence that the original firm, no less than its present successor, was particularly interested in the production and sale of cooking appliances for use with gas. A little later one finds an advertisement for a water heater of the geyser type, so that of its present activities at least three—viz., cookers, gas-fires, and water heaters—were already being developed some sixty years ago. As the school song says, however, "It isn't our ancient lineage, there are others as old as we," and the proof of "long service" lies in the fact not only of survival, but in the more significant one of survival with continuous expansion.

Sharing as it did in the opportunities presented by the nearly virgin soil of the eighties, ploughed (and harrowed!) by the Gas Industry's anxiety to find fresh outlet for its product in case the electrical bogey proved to be real, and fertilized by brains and commercial acumen, the firm went from strength to strength and from one premises to others successively larger, until in 1897 it amalgamated with the doyen of the dry meter business, the firm of Thomas Glover & Co., Ltd., which had been originally established 5 years before the "GAS JOURNAL" itself, and which had actually advertised under its original name of Croll & Glover in the first number of the "JOURNAL," published on Feb. 10, 1849. After the formation of Glover & Main, Ltd., R. & A. Main, Ltd., retaining its identity for manufacturing purposes, moved from Glasgow to a larger site at Falkirk, and at the same time started on another site at Edmonton. In recent years another site has been occupied in Croydon, principally for the production of water appliances heated by gas. These three sites, now practically built up, cover between them some 34 acres.

Origins of the Gas-Fire.

What changes have occurred in the appliances produced during that period of some sixty years of service, and how do the modern ones compare for appearance and performance with their predecessors?

The greatest differences in both directions are found in gas-fires. Early fires range from the so-called gas-fire which seems in those days to have implied any combination of burner and refractory material for insertion in an existing coal grate (see figs. 1, 2, and 3) to self-contained units placed in front of the coal-fire and known apparently as gas grates (fig. 6). All sorts of materials have been used for converting the heat of combustion into radiant heat. In the old Main catalogues illustrations are shown of fires depending on asbestos fibre, iron frets, coke or fireclay lumps, all of which have had their turn. The sequence and currency of these various materials are difficult to disentangle. However, from one pair of catalogues (in this case not Main's) which happen to be dated, we find in 1890 a series of fires all with iron frets, while in 1902 the same fires are again illustrated, but this time with hollow fireclay "fuels." Combinations of the above materials were tried also; for instance, in 1888 R. B. & A. P. Main took out a patent for a back-brick carrying metallic or refractory frets in two parts, like claws, holding balls of refractory material. In 1889 perforated hollow metal shells with studs on the outside and asbestos inside were patented; these were stated to take the place of "fire-clay lumps," while the two Mains patented refractory lumps made by soaking sponge or the like in a "slurry of clay, silicate of soda, carbonaceous material, and sugar or gummy matter." Contemporary illustrations of two "fuels" are shown in figs. 4 and 5. Readers are no doubt familiar with the successive steps since then—how the deep mass of "fuel" became shallower and eventually was reduced to single pieces each over its own flame.

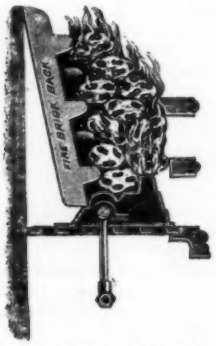


Fig. 1.—"Gas-Fire," consisting of burner, brick, and "fuel" placed in an existing coal grate.

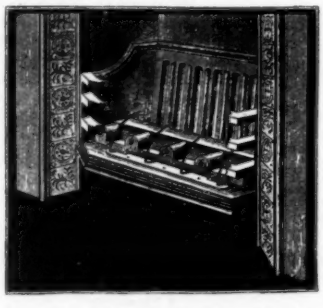


Fig. 2.—"Hepworth Gas Fire" showing a special burner with wire guard to keep the teats clear of "fuel." A brick is also required.

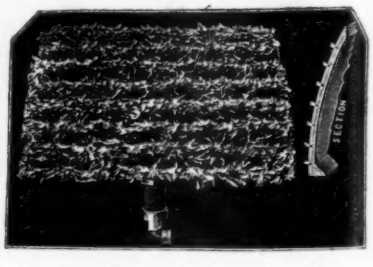


Fig. 3.—"Edinburgh Gas Fire." Asbestos Fibre with flames issuing from holes spread over the whole brick surface.

The present tendency of gas-fire development in design is away from all reminiscence of its parent the coal-fire. Canopies, hearths, and fenders have disappeared or are gradually doing so, and design is directed towards a logical conclusion, thereby resulting in a fire which requires practically no projection into the room space and is completely in harmony with the modern interior. The modern "Starmain" (fig. 7) is only one example illustrating this development. There is also a definite demand for fires like the "Newscreen" (fig. 8), which can be used in any of a number of rooms by means of a plug-in connection. In conjunction with an automatic lighter, this offers the convenience of the electric fire with far greater heating power and economy.

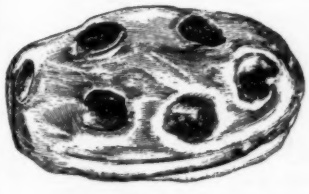


Fig. 4.

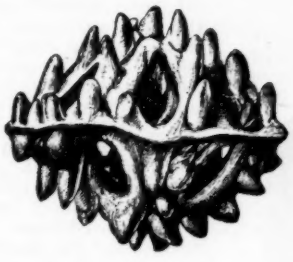


Fig. 5.

Various gas fire "fuels."

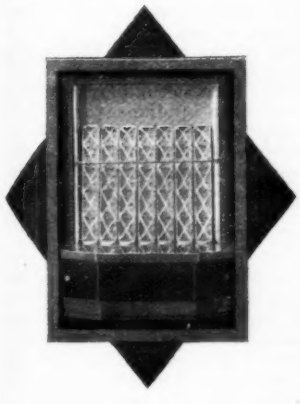
Fig. 6.—Self-contained "Gas Grate" with connecting devices behind the fret work.

Cookers.

The next class of appliances to be traced from the beginning consists of cookers. The earliest model available for examination has luminous jets in the oven, the walls of which are lined with square tiles held in position by screws at the corners where every four tiles adjoin. The drip-pan is attached, as in the latest practice, to a cast-iron strip which, when the pan is pushed home, closes the opening into which it is inserted. The legs consist of wrought iron strips bent to form feet where they meet the floor. The hotplate has wrought-iron boiling burners and no grill, the brass gas-rail is in front of the hotplate (another "modern" touch), and the gas-cocks have long brass lever handles. The illustration (fig. 9) shows a name plate which is a separate casting obviously attached at some time subsequent to manufacture.

Left.—Fig. 7.—The "Starmain." A modern built-in panel fire.

Below.—Fig. 8.—"Newscreen" Fire can be used in any room with plug-in gas cock.



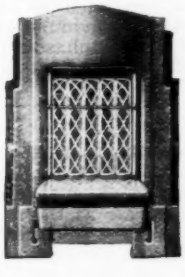


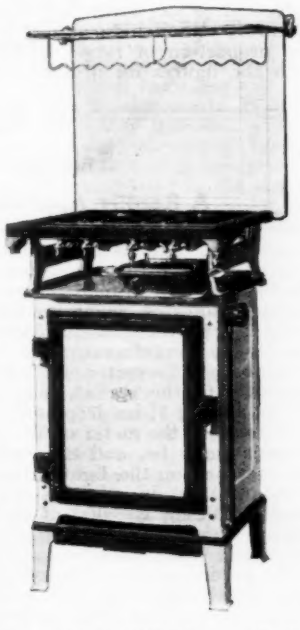
Fig. 9.—Old cooker described in text.

Another illustration shows a two-compartment oven heated by one burner, the lower serving as a boiling or grilling compartment and the upper as a baking oven (fig. 10). This type of oven did not survive here, although when fitted with two doors it became very popular on the Continent.

The outstanding fact about cookers is that with the exception of improvements in detail there is no difference between those of 1885 and those of 1915. In fact, if certain small differences of ornamentation and method of pictorial reproduction were ignored, it would be difficult to tell the one cooker from the other.

Below.—Fig. 10.—The "Little Cooker" with two compartments and a single burner.

Right.—Fig. 11.—"Sussex Deluxe."



After the war, cookers received great attention from the appliance industry, with the result that efficiency, effectiveness, appearance, and convenience were improved out of all recognition. So far as appearance is concerned, the most outstanding difference is in the use of vitreous enamel. The firm of Main gave its attention to this very early, and eventually put before the public, in the "Maintenance Deluxe" model, the first completely enamelled cooker ever produced. Fig. 11 shows the latest model of the "Sussex" in Deluxe Mainamel finish complete with Mainstat and adjustable single plate rack, and with a new splash plate of modern design.

Not the least striking of the advances has been the wholehearted adoption by the public of thermostatic control of

cooking operations. This has been due largely to national advertising by Main and other manufacturers. The firm's "Mainstat" has been in the forefront of this advance, which has also entailed the writing and publishing of the Main Cookery Book that has gone through no less than 25 editions since its first publication in 1929. It is a merit of this book that, in spite of its origin, it is applicable to gas ovens generally, and not confined in its usefulness to its sponsors' cookers only.

Large-Scale Cooking.

Space does not permit more than a passing reference to large-scale cooking appliances. It was principally to make such appliances that Mr. Waddell, who was otherwise a

Fig. 12.

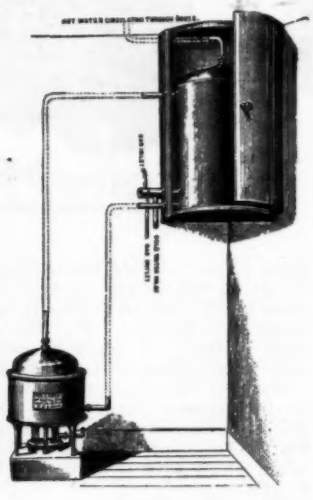


Fig. 13.

restaurateur, helped to found the business which has always made a speciality of this line. In those early days indeed there was hardly any domestic market at all. Now, however, although the relative outputs are reversed, and the proportion of large appliances made by comparison with the figures for ordinary cookers is relatively small, yet large-scale appliances continue to account for a quite considerable and ever-growing tonnage.

Water Heating.

The direction in which much advance has taken place of late years has been in water heating. The Gas Industry has realized what a large field this offers for the use of its main product. R. & A. Main, Ltd., have from the very first offered gas-fired water heaters for the use of the public, and some of the old appliances are shown in the accompanying illustrations. It will be noticed that the geyser (fig. 12) and the circulator (fig. 13) are represented. The only striking difference in principle today (if it is a difference) is in the use of low-consumption storage heaters, which build up an accumulation of hot water, and which cannot, of course, give a greater output than is proportional to the limited input of heat. This type suits many gas undertakings and their consumers for various reasons. On the other hand, spot heating of unlimited quantities of water by a geyser type of appliance with automatic valves has much to recommend it, where the facilities of main and meter are adequate, not least in that it is a service that cannot be afforded by our electrical competitors.

Fig. 14.

G.L.C. Single Point Water Heater.

An attempt has been made in this article to contrast the early appliances with the latest models, thus showing the progress up-to-date. In another direction it is interesting to contrast the presentation of early catalogues with that of the latest issues. For instance, the wood engravings that were then used to illustrate appliances look very archaic against the reproductions of natural colour photographs which appear in the Main 1936 Cooker Catalogue just issued.

This brings to mind that the blocks used for illustrating this article come from makers who reveal that they still have on their staff an engraver who actually remembers working on wood engravings of Main appliances some fifty years ago when he was an apprentice—an interesting example of individual long service which happens to coincide with and emphasize the communal long service afforded by the firm of R. & A. Main. Ltd., to the Gas Industry.

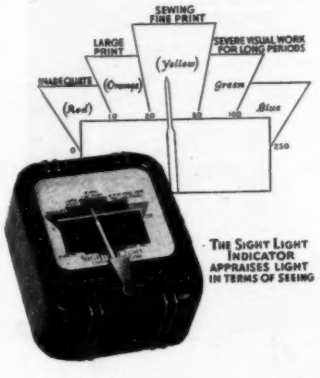
Selling Light

A Readily Appreciated Indicator

The selling of light adequate for any specified purpose as easily as a shopkeeper supplies measured quantities of goods to the customer's orders has now been realized by the introduction to popular use in America of the "Sight-Light" Indicator, which the International General Electric Company, Crown House, Aldwych, W.C. 2, are undertaking shortly to manufacture and market in England. The "Sight-Light" meter is self-contained and will conveniently fit the pocket, measuring only 2⅞ in. wide by 2⅛ in. long by 1⅛ in. deep and weighing but 7 ozs. One has only to place the meter on the desk, machine, &c., such as the case may be, and the customer at a glance will see whether or not the light intensity is up to the required standard, for, in addition to being graduated in foot-candles (0-250), the dial of the meter is divided into five coloured zones—viz., inadequate, large print, sewing fine print, and (two) severe visual work for long periods.

We are informed by one of our American correspondents that the electrical industry in that country, which is built up as it were on a base lighting load, has met with great success by the adoption of a publicity campaign backed by the formation of "The Better Vision Institute." The campaign thus embraces a health appeal which in recent years has been turned to great advantage by many industries, including our own. "Better Light—Better Sight" is the war cry of the Institute, and American newspapers and magazines have been full of advertisements urging the public to preserve and improve their sight by improving their light. Owing to the fact that some thirty to forty years ago the American Gas Industry was forced to hand over to the electricity interests the whole of the lighting load, the gas executives there are not directly interested in the scheme. But here in Britain we have an opportunity to extend our domestic lighting business. The "Better Light—Better Sight" appeal, supported by the convincing tale told by the Sight-Light Indicator, provides a new channel for approaching the consumer with a view to improving and increasing existing domestic lighting. All things being equal, gas reigns supreme as the best artificial light so far as the preservation of eyesight is concerned, and the free use and interpretation of the Sight-Light Indicator should go far in the provision of a better light service, with due regard to economy, for any specified task.

What do "foot-candles," "lumens," and other lighting phraseology mean to the average man? At best very little.



That is the reason for the existence of this Sight-Light Indicator. The principle of its operation is simple. The light to be measured falls upon a selenium cell which generates an electro-motive force directly proportionate to the intensity of light falling upon its surface. This e.m.f. causes a minute current to flow through an adapted electric meter which is calibrated in terms of foot-candles. The foot-candle readings are then "zoned" as described above, which interprets the light intensity. It is claimed that the instrument does not deteriorate even on exposure to sunlight.

THE USE OF TOWN GAS

For Vitreous Enamelling

by
W. DIETERICHS
and
P. LLOYD
of the Gas Light and Coke Company

From a Paper read before the Institute of Vitreous Enamellers at a Meeting held in London on Thursday, Feb. 13.

In considering the general aspects of our subject it becomes evident at once that there is a dual bond of interest between your industry and that which we represent, for the Gas Industry is not only a potential supplier of fuel to the vitreous enamelling industry, it is also the purchaser of a great bulk of vitreous enamelled ware, largely in the form of gas cookers, but also as flue material, lighting fittings, &c.

You will all be familiar with the increase that has taken place in recent years in the sale of enamelled gas appliances, and you will realize that many Companies, like the Gas Light and Coke Company, are now purchasing no cookers except with a vitreous enamelled finish. You may, nevertheless, be interested in the following figures which illustrate the growth in the number of vitreous enamelled cookers installed during recent years. They refer to the Gas Light and Coke Company alone, and it will be readily appreciated that the figures for the country as a whole are of quite a different order of magnitude:

Number of Vitreous Enamelled Cookers Issued per Annum.

	Total.
1933	30,000
1934	45,098
1935	176,058

A point which is also worth mentioning is that other vitreous enamelled products, such as kitchen ware and baths, are closely associated with the use of gas and coke as fuels.

The fuel requirements of the vitreous enamelling industry are, in the main, three operations requiring heat:

(1) Frit melting,
(2) Drying,
(3) Fusing the enamel,

and the theoretical heat requirements for these three processes may be roughly estimated as follows:

Frit melting	850 B.Th.U per lb. of frit. 137 B.Th.U. per sq ft of enamelled surface (two coats), assuming 0·06 lb./sq.ft. for the grip coat and 0·1 lb./sq.ft. for the colour coat.
Drying	120 B.Th.U. per sq.ft of enamelled surface (one coat), assuming 0·25 lb. enamel per sq.ft.
Fusing the enamel	185 B.Th U. per lb on cast iron. 800 B.Th.U. per sq ft. of enamel (two coats on 18 gauge metal).

In the first process the heat is required to melt the glass, and the theoretical heat requirement has therefore been taken as the total heat above 60° F. of a typical batch at the pouring temperature. In the second process the heat is necessary to evaporate the water from the applied coating, and the theoretical heat requirements have been taken as the heat necessary to evaporate the water. It is true that the evaporation of the water is not accomplished without heating the iron to the temperature of the drier, and the sensible heat of the metal might have been included in this estimate; it has been omitted for reasons of expediency. In the fusing operation theoretical heat requirements have been taken as the total heat in the useful load above room temperature.

Anticipating the results given in the latter part of this Paper, it may be mentioned that the gross heat units required in practice to carry out these three operations are of the following order of magnitude:

1.	Frit melting	5,000 B.Th.U. per lb. of frit equivalent to about 800 B.Th U. per sq.ft. (two coats).
2.	Drying	65 B.Th.U. per lb. of cast iron equivalent to about 400 B.Th.U. per sq.ft. of enamelled surface.
3.	Fusing	920 B.Th.U. per lb. (cast iron). 8,000 B.Th.U. per sq.ft. (sheet iron, two coats),

the corresponding thermal efficiencies being therefore

1. Frit melting . . . 17%.
2. Drying. . . . . 30%.
3. Fusing. . . . . 10%–20%.

Frit firing is shown to be a highly inefficient operation, and it might appear at first sight that furnaces could easily be designed to give much better utilization of heat. A consideration of the process reveals, however, that the problem is by no means an easy one. The main source of heat loss in the process is the flue, and with any normal operation the sensible heat in the flue gases would be recoverable by the use of some recuperative or regenerative system. In this case no such recovery is possible by normal means, since the hot waste gases carry forward small particles of enamel which would very soon put any recuperator out of action. This same difficulty has, of course, been overcome in the case of glass furnaces, and a similar solution may perhaps be found for frit melting.

The drying operation offers no great difficulties and does not use any very great quantity of heat, and in any case much enamelled ware is air dried, but it may be pointed out that it is an operation demanding a flexible easily controlled fuel, and in fact town gas is being very extensively used for the purpose.

The firing operation is not only that consuming the greatest proportion of fuel, and therefore the most interesting to the Gas Industry, but is also the most difficult, and consequently the most interesting from the enameller's point of view. The efficiency obtained in practice is not unreasonable, especially when it is borne in mind that this is a "net" figure taking no account of the perretts which may easily treble the effective weight of the load. There is no doubt, however, that these figures can be and will be improved upon, and it is hoped that town gas will play an important part in effecting this improvement. It seems that present practice in the enamelling industry already demands rigorous control of temperature and of furnace atmosphere, and it may be anticipated that in this process, as in so many others, the precision required in the control of the furnace will tend to increase. If this happens the result will be to place a premium on the fluid and easily controlled fuels.

It appears that at current prices there is a very wide divergence between the price per therm of the crude fuels, such as coal, and that of refined fuels such as town gas or electricity, which must be included, although it is not, strictly speaking, a fuel. One reason why the more expensive fuels are able to compete successfully with the cheaper ones for operations of this kind is that they enable higher thermal efficiencies to be obtained. Electricity, for instance, starts off with the advantage that flue losses are eliminated. Town gas comes next on the list, since it enables heat application to be localized as required, and it gives much closer control over the combustion process than any other fuel. Fuel oil may show a somewhat higher thermal efficiency than that obtained with solid fuels on account of the greater ease of application, and may be ranked as occupying an intermediate position between solid fuels and the highly refined fuels, gas and electricity.

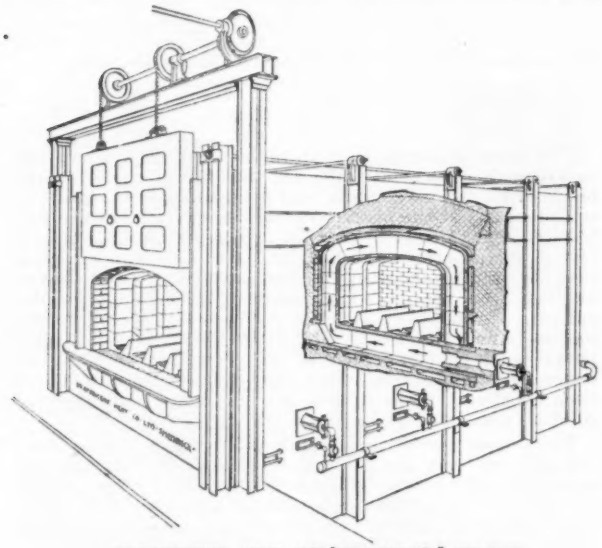
In considering fuel costs, it must always be the cost of the therm usefully employed that is taken as the criterion and not the price of the raw fuel. A manufacturer is not concerned with the thermal efficiency alone, but rather with the overall "manufacturing efficiency," which involves such important factors as the following: Quality of product, percentage of rejects, continuity of operation (time lost in breakdowns, repairs, &c.), maintenance cost of furnace, cost of stoking and supervision, cost of storage of fuel, cost of ash removal.

All these factors must be allowed for in calculating the overall fuel costs, and it is clear that they must not only tend to react in favour of the higher grade fuels, but may also outweigh considerable differences in the cost of the fuel per therm usefully employed. In the case of town

gas, for instance, the advantages may be summarized as follows:

(1) Unvarying quality of fuel supplied.
(2) Reliability of supply and operation.
(3) Low sulphur content.
(4) Ease of operation under negative pressure resulting in the minimum vitiation of furnace atmosphere.
(5) Long life of refractories.
(6) The absence of storage and ash removal, and a minimum of supervision.

When it is considered that the vitreous enamelling industry is producing relatively high priced commodities and



INCANDESCENT HEAT CO'S "EQUI-RADIANT" FURNACE

Diagram of a typical gas-fired enamelling furnace, showing the passage of the hot gases round the muffle.

that the fuel costs are, after all, small in comparison with other production costs, it will be appreciated that such factors as those mentioned above are of more than theoretical interest.

A question of some importance is the possibility of using inflame furnaces for the fusing of enamels. The authors are well aware that the present tendency in the industry would seem to be towards the exclusive use of muffle furnaces with ample ventilation of the muffle, and they feel a certain diffidence in raising the question at all, but the published evidence on the subject, most of which is American in origin, does not seem to provide sufficient basis for the absolute rejection of this possibility. So many cases have been experienced in other industries where the use of muffle furnaces was held to be essential until the use of town gas came to be investigated, that a thorough examination of this aspect of the problem would seem to be justified. It will be realized that the possibility of using oven type furnaces is especially important on account of the much greater thermal efficiency which can be obtained by their means. It would be extremely interesting to hear the views of members on this subject and to learn from them which constituents of the furnace gases have been found in practice to exert objectionable influence on the enamelled surface, or alternatively, what percentage of oxygen is considered essential in the muffle atmosphere.

The logical development of vitreous enamelling furnaces would seem to be in the direction of continuous operation, since this not only increases the efficiency of heat application, but also enables a closer control of temperature to be obtained. It may be anticipated, therefore, that in spite of the known objections to continuous furnaces—*e.g.*, lack of flexibility compared with batch furnaces—these may begin to be used in this country before very long.

Present Practice.

It is universally realized that the temperatures required for enamel fusing are very readily obtainable with town gas without the use of any forced air supply, and the elimination of the fan and motor for supplying the air blast has various advantages besides the primary one of simplification. For one thing, the operation of the furnace on natural draught ensures the production of a slight negative pressure in the flue system so that the chance of contamination of the muffle atmosphere is very much reduced; for another, the soft luminous or semi-luminous flame is at a lower temperature than the air blast flame, and consequently imposes less strain on the refractories. Various systems have been devised by the furnace makers for the application of this type of flame to vitreous enamelling furnaces.

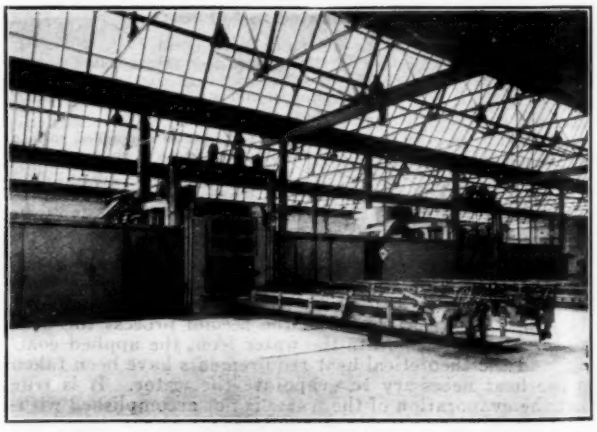
Another branch of gas firing technique which has recently shown some development is the automatic control of temperature. This may now be carried out with an accuracy equal to ± 1% of the scale reading of the instrument used for measurement, and no supervision is required, apart from the original setting of the temperature control.

A typical gas-fired enamelling furnace (the Incandescent Heat Company's Equi-Radiant furnace) is illustrated.

Test Results.

In connection with this Paper, an effort has been made to obtain test results on a number of typical installations using a variety of fuels, and a considerable number of tests have been carried out. It must be admitted, however, at the start, that great difficulty has been experienced in obtaining results in comparable form. One difficulty is that the working efficiency of the furnace obviously depends on the rate of throughput, which is not easily standardized except for a short period, and a test over a short period is, of course, valueless owing to the intermittent nature of the operation. Perhaps the most awkward problem concerns the methods of expressing the results obtained. Clearly the heat in the load would be most easily expressed in terms of the gross weight of the charge—that is to say, the weight of the load plus perretts—but this takes no account of the fact that in continuous operation the perretts are necessarily warm at the time of entering the furnace. The effective output, especially on sheet metal, would seem to be more logically measured in terms of the area enamelled, but this method does not enable any allowance to be made for the weight of the perretts. By way of compromise it has been found necessary to express results on sheet metal work in three different ways, in fuel consumption per square foot enamelled, fuel consumption per pound net, and fuel consumption per pound gross. In dealing with castings, the results have been expressed in terms of the weight basis alone. Among the other variables which are bound to affect the results and for which no proper compensation can be made, are the firing temperature, the firing time, and the shape factor which governs the quantity of material inserted in a given charge.

Another fundamental problem in connection with the testing of these furnaces is the question whether to take aggregate production figures and fuel consumption figures over an extended period (a week, a month, or a quarter),



An Installation in a London Factory.

and so to obtain figures based on normal production, or to carry out spot tests on periods of 4 to 8 hours. The latter method has the advantage of enabling the results to be more fully dissected, but it is open to the objection previously mentioned that the results are unduly influenced by the rate of throughput. It is unfortunate but inevitable that the results obtained are not on a uniform basis, since the figures for oil and gas were taken on spot tests, whereas those for coke refer to a whole quarter's operation.

The results obtained may be considered in the same order as before:

1. *Frit Melting.*

In this case information is only available on gas fired installations. In one case the installation consists of two

rotary furnaces, 4 ft. in diameter by 7 ft. 6 in. long, and capable of producing 500 lb. per batch, the average time of melt being 2½ hours. These are fired with low-pressure gas and air at 8 in. w.g. pressure, and temperatures up to 1,350° C. can be obtained. The average results over about nine months' working are:

For primary coats . . = 0·049 therm/lb. of frit.
= 9·8 cu.ft./lb. (500 C.V.).
For white coats . . . = 0·05 therm/lb. of frit.
=10 cu.ft./lb. (500 C.V.).

In a second installation of the same kind, also consisting of two rotary furnaces, but used much more intermittently, the results obtained on a spot test, starting with a cold furnace, and making frit for primary coats were:

0·0725 therm per lb. of frit.
= 14·5 cu.ft. per lb.

2. *Drying.*

As an illustration of the type of results to be expected in the drying of castings after spraying, a test has been carried out on a conveyor oven installation. This oven was working at a temperature of 130° F., and the following test results have been obtained.

A.
Throughput per hour . . . . . = 7,370 lb.
Gas rate . . . . . = 1,000 cu.ft. per hour
Giving a gas consumption per lb. of . 0·136 cu.ft.

B.
Throughput per hour . . . . . = 5,430 lb.
Gas rate . . . . . = 690 cu.ft. per hour
Equivalent consumption . . . . . = 0·125 cu.ft. per lb.

3. *Fusing Enamel.*

(*a*) *Gas Firing.*—Tests have been carried out on three separate installations, each consisting of a pair of gas-fired furnaces. In the first installation sheet metal work alone was handled, one furnace being used for grip coats while the other dealt with the colour coats. In this case, the nominal muffle size of the furnace was 15 ft. by 5 ft. The results are given in the following table:

Process.	Temp., °C.	Throughput, Lb. per Hour.	Gas Consumption (500 C.V.). Cu.Ft. per Hour.	Cu.Ft. per Sq.Ft.	Cu.Ft. per Lb. Net.	Cu Ft. per Lb. Gross.
Fusing colour on sheet iron (flat loads), (average of 4 runs) .	800	2,830	3,580	7·49	3·71	1·26
Fusing grip on sheet iron (flat loads), (average of 2 runs) .	875	2,135	3,410	9·46	4·75	1·6

In the second installation one furnace was used for cast iron and one for sheet, the nominal muffle size of the furnace being 12 ft. by 4 ft. 6 in. The following results were obtained:

Process.	Temp., °C.	Throughput, Lb. per Hour.	Gas Consumption (500 C.V.). Cu.Ft. per Hour.	Cu.Ft. per Sq Ft.	Cu.Ft. per Lb. Net.	Cu.Ft. per Lb. Gross.
Fusing colour on sheet iron	840	1,130	2,230	11·8	4·78	1·98
Degreasing sheet iron	840	1,620	2,770	10·63	4·27	1·77
Enamelling cast iron.	740	1,335	1,720	..	1·84	1·28

In the third installation one furnace was used for grip and the other for colour coats, but by special arrangement all the tests were carried out in the one furnace, the nominal muffle size being 15 ft. by 5 ft. The following results were obtained:

Process.	Temp., °C.	Throughput, Lb. per Hour.	Gas Consumption (500 C.V.). Cu.Ft. per Hour.	Cu.Ft. per Sq.Ft.	Cu.Ft. per Lb. Net.	Cu.Ft. per Lb Gross.
Fusing grip (flat loads)	875	1,980	3,290	9·5	5·27	1·66
Fusing grip (stand loads)	875	2,850	3,570	8·2	4·43	1·23
Fusing colour (flat loads)	800	2,390	3,530	7·85	4·31	1·48
Annealing castings (stand loads) . .	800	2,510	2,680	..	1·56	1·07

In reviewing these figures, the most consistent measurement would seem to be that of gas consumption per lb. gross load, which varies between 1 and 2 cu.ft. Gas consumption per lb. net shows approximately a fourfold variation, while on sheet iron the consumption per square foot varies from 1 to 12 cu.ft.

The results claimed for continuous furnaces are, of course, very much better than those given above, being of the order of 2·4 cu.ft. per square foot of surface enamelled, but of these furnaces the authors have no actual experience.

(*b*) *Fuel Oil.*—Tests have been carried out on two separate installations, a single furnace being examined in each case. For various reasons, these figures cannot be considered as precise as those obtained on gas firing, and there was, in fact, considerable difference between the results on the two installations. The figures obtained on the second installation have had to be omitted since the only method of measuring the oil supply was by meter, and the instrument used was found after the test to be giving extremely erratic readings at the rate of flow obtained in practice. It is only fair to state, however, that the results on the second installation appeared to be appreciably better than those obtained on the first installation. Size of oil furnace 12 ft. by 4 ft. 6 in. The results were as follows:

Process.	Temp., °C.	Throughput, Lb. per Hour.	Oil Consumption. Galls. per Hour.	Galls. per Lb. Gross.	Equivalent Gas Consumption per Lb. Gross.
Fusing colour on sheet iron	840	1,000	9·37	0·0086	3·06
Fusing grip on sheet iron	880	1,000	9·81	0·0098	3·48

(*c*) *Coke.*—Results obtained on coke are based, not on a spot test, but on a quarter's actual operation with four furnaces with a nominal area of 9 ft. 6 in. by 4 ft. working 144 hours per week. These figures are obviously not strictly comparable with those previously quoted, since the rate of throughput must be very much less over an extended period. Furthermore, the output figure is based not on the quantity of material actually passing through the furnace, but on the quantity despatched during the corresponding period, so that no allowance has been made for refirings, rejects, &c. Working on this basis, it has not been possible to analyze the figures to obtain separate results for grip and colour coats, but no cast-iron work is included. The results are as follows:

Period of Test.	Total Output, Sq.Ft.	Coke Consumption. Total Consumption.	B.Th.U. Consumed.	B.Th.U. per Sq.Ft. of Surface.	Equivalent Gas Consumption, 500 C.V.	Equivalent Gas Consumption per Lb. Net.
Weeks. 13	1,534,000	Tons. 370	$107·8 \times 10^6$	7,020	14·1	Cu.Ft. 8

Conclusions.

In conclusion, it may be worth pointing out that in the past few years there have been innumerable occasions when town gas has been adopted for processes previously carried out by means of cheaper fuels—producer gas, coal, or fuel oil—even when fuel cost was a major item in determining the production cost of the article. Very often the manufacturers responsible began by feeling that the great difference in raw fuel could never be adequately made up for by such increases in efficiency as have been suggested in the first section of this Paper. In almost every case a trial of town gas firing, providing only that the right furnaces or appliances were installed, has shown that the incidental advantages easily outweigh the increase in fuel cost, which is often much less than has been anticipated.

It would seem justifiable to conclude that vitreous enamelling is likely in the near future to provide a useful field of application for town gas.

Discussion.

Mr. CHIFFEY, commenting on the authors' reference to muffles being made of either metal or ceramic ware, said he believed that a silicon-chromium-aluminium alloy had been tried out on superheater tubes. He asked whether any work had been done on the making of metal muffles for vitreous enamelling furnaces to be heated by gas.

Mr. UNWIN was very interested in the authors' remarks concerning the Equi-Radiant furnace, the design of which was attractive; at the same time, he asked for the experience of users as to the kind of heating they obtained with it. In enamelling works one heard various opinions expressed as to the presence

of or the lack of bottom heat, and he wondered what was the experience of users with the new type of furnace.

Discussing consumption figures, he said the consumption of 5,000-B.Th.U. per lb. of frit, by gas-fired rotary frit melters, was almost exactly the average figure obtained in respect of rotary frit melters using oil. So that apparently, with that type of furnace, the number of therms required to melt a given quantity of frit was almost the same, irrespective of whether gas or oil was used for firing.

Dealing with inflame furnaces, and the authors' question as to which of the products of combustion had a deleterious effect upon enamel ware, he suggested that sulphur was the troublesome constituent and constituted the great snag against the use of open-flame furnaces for enamel work. However, he had seen in operation a semi-open flame furnace in which the products of combustion had access to the chamber when firing batches, and quite good results were obtained with it, although it was not considered advisable to use that type of furnace for first-class ware. The steam in the products of combustion might also have an effect, and he urged that a great deal more experimental work was needed before that type of furnace should be used for enamel ware.

Continuous furnaces seemed to have made progress in America, but it would appear that there had not been any really definite movement made in their development in this country. At the same time, if sufficient production were required, he did not see why some sort of tunnel kiln should not be used in the enamelling industry, for it was used for such materials as tiles, and, after all, the glazing of tiles was a similar sort of process.

Mr. J. H. GRAY, referring to some results given by the authors for fusing enamel, where a 15 ft. by 5 ft. furnace, fusing colour on sheet iron, gave a throughput of 2,830 lb. per hour, the gas consumption (using a 500 B.Th.U. gas) being 3,580 cu.ft. per hour, asked whether the weight of 2,830 lb. of sheet iron per hour included the weight of perretts; if not, that figure would have to be about doubled when the weight of the perretts was included. If that were so, would the gas consumption also be doubled.

Mr. DIETERICHS replied that the weight figure was the gross weight, including perretts.

Mr. KENNETH HILL, commenting on the authors' statement that electricity was available usually at ½d. per unit, said that another industry in which he was interested obtained electricity at a price considerably lower than that.

A Clean and Prepared Fuel.

Mr. J. FALLON (Managing Director, Incandescent Heat Company, Ltd.) said that the authors had not made many controversial statements, because they had dealt with specific facts derived from practice; and if he joined issue with them at all it would be because they had erred on the safe side. He contested some of the consumption figures as being rather higher than those which *could* be obtained in practice; but he would attack both the authors and Mr. Unwin upon having to some extent drawn a red herring across the trail and perhaps misleading the meeting in referring to B.Th.U., calorific values, and so on. There must be a specific reason for referring to coal at 0·9d. per therm, and for saying that it was possible to use oil instead at 2·3d. per therm. Presumably Mr. Unwin would claim that the reason was that oil had a greater convenience factor than coal, with which, of course, Mr. Fallon fully agreed. But in the application of a clean and prepared fuel which required no attention at all before use, a still greater convenience factor was obtained. In the application of both solid and liquid fuels, high combustion chamber temperatures were necessary in order to secure the transmission of heat necessary into the actual working chamber. It was quite common practice to attain combustion chamber temperatures in oil-fired furnaces up to 1,400° and sometimes 1,500° C. In the specific type of furnace referred to, the combustion chamber temperature was of the order of from 50° to 75° above the working chamber temperature; the furnace was working at, say, 900°, and the internal combustion chamber temperature was of the order of 950° or 975°. When using refractories which had been burned to 1,450° or 1,500° C., there was a fairly considerable margin of safety; but that margin did not exist where it was necessary to maintain combustion chamber temperatures, say, from 400° to 500° C. above the working chamber temperatures. The point was that the heavy depreciation that occurred where the high combustion chamber temperatures were necessary was practically eliminated when one used a gas furnace. A high-alumina refractory (say, 44%) burned at 1,450° to 1,500° C., and used at 950° C., had an almost indefinite life. While he was not condemning oil furnaces, one might expect that they would require a major repair within two years; whereas a gas furnace, in which the zones could be individually controlled with great facility, should easily give 15 years' life without needing a major repair. That was a very important item, because the manufacturer would usually run the furnace as long as he could, consistent with the quality of the goods made. The depreciation commenced from the first week of working, and in a furnace which would need major repair only after 10 or 15 years the quality of the work was naturally maintained at a higher level over a period of years than in a furnace which needed a major repair every two years, by reason of the slower rate of depreciation of the former. The depreciation factor, the convenience factor, the elimination of auxiliary apparatus, and the fact that gas was brought right to one's door, giving every possibility of increased loading when desired, together with the fact that one was using a prepared and refined fuel, were all in favour of gas, which had very much to commend it. Indeed, knowing the work the authors had done in the Industry, one felt that they had not stressed that aspect as heavily as they might have done. There was an enormous field for the application of gas in the vitreous enamelling industry.

With regard to bottom heat, he said the first circuit of the heat was in a well below the hearth, where the atmosphere to the furnace was heated above its natural level and introduced vigorous convection currents which penetrated the load and gave uniformity of heat transference.

Recuperation and Efficiency.

Mr. SKINNER (South Metropolitan Gas Company), who asked if anything had been done to improve the efficiency of fritting, said he knew from experience that one type of recuperator had not proved successful. He ventured to suggest that the products of combustion of gases lent themselves well to that form of recuperation; if they were carrying with them a particle of enamel or other harmful substance it might be well to pass the air required for the combustion of gas in the frit kiln through the tubes, to use a recuperator of the hairpin type (where the tubes were suspended or cantilevered out from a header), and to use some form of scraping mechanism, such as that applied in the Green's economizer for boilers, to keep the outside of the tubes clean. One of the greatest disadvantages of oil firing, and perhaps also of solid fuel firing, was that owing to the intense combustion chamber temperatures, not only were the refractories punished very severely, but the radiation losses around that region tended to become very high indeed.

Mr. STONE said that, although reference had been made in the Paper to supplies of gas at 1s. 8d. per 1,000 cu.ft., he had yet to find a supply authority that would offer it at that price. Probably it could be obtained at that price in London, but there were not many gas undertakings in the country that would supply at much less than about 3s. per 1,000 cu.ft. Gas was probably a very good fuel to use, if it were available at a convenient price.

Mr. REID drew attention to the interests of the enameller who was carrying out the enamelling process, and pointed out that it made a very great difference to him whether an oil-fired or a gas-fired furnace was used. More often than not, "sulphuring" was very prevalent when using an oil-fired furnace, where there was a lot of positive pressure. That was a matter which should be taken into account when considering oil as against gas; in a furnace using gas there was a negative pressure, and "sulphured" products did not occur so frequently as when using oil, so that there was a larger percentage of good clean work and a smaller percentage of rejects. It would seem that that would be a determining consideration in the choice of fuel.

Mr. SKINNER pointed out that surely it was a decided advantage to be able to use the one fuel for the various purposes in a factory—and gas was extremely useful not only for fritting and for the actual stoving of the enamel after it was dried, but also for drying. He also pointed out that many enamellers did not operate their furnaces continuously for 24 hours a day, and he asked what was done to maintain the temperature of a furnace at a reasonable level when it was not actually in production, for the life of a furnace would depend upon that to a great extent. In the case of an oil-fired furnace which had to be closed down for a period of hours, for instance, was it considered sufficient just to shut off the dampers and allow the temperature to fall slowly; or was it better to use an apparatus such as a gas-fired furnace, where one could provide a moderate supply of heat to balance that slow fall, so that the furnace was ready for work immediately it was required?

The CHAIRMAN (Mr. B. B. Kent), who claimed to be the user of the first of the Equi-Radiant type muffles, said that although he had no records so exact as those put forward by the authors of the Paper, the actual operating costs were higher than on oil-fired muffles; but the total costs over a period of a year were less in the case of the Equi-Radiant muffles. A number of factors contributed to that result. The combustion chamber temperature was practically the same as the muffle temperature, and over a period of about 2½ years no repairs at all had been necessary in the case of the Equi-Radiant muffle, whereas the oil muffles had to be shut down about once every three months for a few repairs. Further, the quality of the work from the gas-fired muffle was considerably higher; indeed, when the first gas-fired muffle was installed one could detect the difference between the work carried out in the gas-fired and the oil-fired muffles when the pieces were piled in the stockroom.

Mr. Dieterichs Replies.

Mr. DIETERICHS replied to the discussion. Dealing first with the criticism that he could have given better figures for gas, he said it was always his policy not to give figures which he was not prepared to substantiate. He pointed out that they, as a body of expert vitreous enamellers who knew their fuel costs, would know that the figures given were, if anything, on the high side, and could perhaps be reduced, but he preferred to give figures which were obtained under actual working conditions.

Replying to Mr. Stone's request for figures in terms of costs per hour, he said that they were, in fact, given. Figures had been quoted for furnaces of different sizes whose hourly consumption ranged from 2,600 to about 3,600 cu.ft., but in actual practice these consumption figures could, under certain conditions, be reduced.

With regard to Mr. Unwin's statement that oil consumption compared very favourably with gas consumption in terms of

B.Th.U., he said that if that were so, and if the cost of oil were 2¼d. per therm as compared with gas at 4d. per therm, there would be a difference in fuel costs in favour of oil, but as one or two speakers had hinted, that was not the whole story, since one had to consider, not so much the cost of fuel per hour, but the cost of operation over a period of a year. From the results so far obtained it would appear, with gas at practically twice the price of a competing fuel such as oil, the overall costs at the end of a year were in favour of gas, apart from the additional advantage of greater convenience.

Before he had become closely concerned with vitreous enamelling he had been interested, of course, as a user of vitreous enamelled ware, and on one occasion, when he and a colleague had been walking through the stores at Watson House, they had noticed a difference between certain white enamels. They had traced the enamelled ware back to the factory and found that the same difference was apparent, the reason being that one batch had been produced in a coke-fired furnace and the other in a gas-fired furnace. As a result, he had maintained a careful watch and found that the same results were produced in oil-fired furnaces as with the coke-fired furnace. He recalled the reference made during the discussion to the furnace or combustion tubes being under a slightly negative pressure and said that the oxidizing conditions were apparently much better in a gas furnace than any other, which might account for the brilliance about the enamelled ware produced in a gas-fired furnace.

With regard to the building of muffles of steel, he said that the question was being looked into carefully, but one of the chief problems was that of the cost of heat-resisting steel which it was necessary to use for such furnaces. The industry was naturally interested in keeping down the capital cost of the plant as much as possible, but if any appreciable increase in efficiency were obtained by using steel, as had been found with small furnaces, he felt certain that in the long run it would prove to be the better proposition.

Repairs to Reinforced Concrete by the "Gunite" Method

A Meeting of the Midland Junior Gas Association was held on Feb. 6, when Mr. G. C. PEARSON, M.Inst.C.E., Engineer of the Windsor Street Works, Birmingham, gave a lecture, illustrated by lantern slides and films, on this subject.

In opening the meeting, the PRESIDENT (Mr. F. L. Atkin) said members would agree that the Association was to be congratulated upon having Mr. Pearson with them. He had always taken a great interest in the Midland Juniors and at one time was their President, and he felt that the success which the Juniors were now enjoying was in no small measure due to the efforts of Mr. Pearson in the early days. The lecture which they were to hear was a very popular one and had already been given before the Midland Association of Gas Engineers and Managers, the Midland Section of the Institution of Civil Engineers, and the Junior Institution of Engineers.

Mr. Pearson then gave his lecture, which was published in the "GAS JOURNAL" for Nov. 1, 1933.

Discussion.

The PRESIDENT, in opening the discussion, said he presumed that the structures repaired with Gunite were stronger than ordinary good concrete structures because Gunite itself was stronger than the original concrete and had a case-hardening effect. That being so, he wondered if it would be advantageous in erecting new structures for them to be made up first with ordinary moist concrete, and then a covering of Gunite.

Mr. F. A. JENKINS (Leamington), in proposing a vote of thanks to Mr. Pearson, said that the work carried out at Windsor Street could well be described as a "major operation," and thanks to Mr. Pearson's skill, a very successful one. The position of the reinforced bars as shown on the slides compared with the original correct position was very illuminating. He had been particularly impressed by the increased strength obtained by using washed and double-washed sand. They all realized the importance of using clean material and washed sand, but the great increase in strength mentioned by the lecturer had struck him as being a most important feature. He asked if the cement used was an ordinary Portland cement or of a special character. Were any special means provided for supplying the water of hydration after the setting of the Gunite mixture?

Mr. E. T. PICKERING (Birmingham), in seconding the vote of thanks, wondered what was the life of a ferro-concrete structure and if the Author thought it would last longer than the plant itself. He was struck with the amount of deterioration which had taken place, and presumed that Gunite was much less porous than the original material. He asked if there was any danger of further corrosion taking place and what measures had been taken to protect the ferro-concrete.

Mr. WILSON (of the Woodall-Duckham Company) thanked the Association for the invitation to be present and said how much he had appreciated listening to Mr. Pearson's interesting lecture. There was no doubt that he had made a thoroughly good job of the repairs.

Mr. A. W. ATTWOOD (Coventry) said the lecturer had shown how careful it was necessary to be in laying reinforced concrete to avoid the trouble and expense to which Mr. Pearson had been put. He asked if the Lecturer had found much corrosion of the reinforcement bars in the original structures, and, if so, how had it been dealt with. He also wondered if deterioration had been found in the foundations of the structures.

Mr. W. MACNAUGHTON (Wolverhampton) said he had some experience of ferro-concrete work, and in his opinion such work needed 100% supervision. He asked if test cubes were taken of cement batches while the work was being done, and whether Mr. Pearson had had any experience with Gunite for lining water tanks or tar and liquor tanks. Had any signs of hair cracks on the surface been noticed since the Gunite repairs were completed?

Mr. J. H. WAINWRIGHT (Halesowen) asked for particulars of the cost of Gunite. In view of the strong supports which were required before some of the stanchions could be treated, he wondered if it would not, in some cases, have been cheaper to have taken down some of the structures and built new ones.

Mr. S. K. HAWTHORN (Birmingham) was impressed with the magnitude of the repairs undertaken and could imagine what an anxious time Mr. Pearson had had as some of the structures looked very unsafe.

Mr. PEARSON, in replying to the discussion, said how much pleasure it had given him to visit the Association once more. If concrete were properly constructed the question of repair would not arise for many years. The causes of deterioration had been established as due to the five main reasons mentioned and illustrated in the slides:

(1) Insufficient cover of concrete over steel.
(2) Bad mixing.
(3) Insufficient tamping.
(4) Careless placing of steel.
(5) Excess of water in concrete.

He said it had to be borne in mind that in applying Gunite in the way which he had done, it was necessary first to determine whether such repairs would be effective. They had a strong material, but it had to be ascertained whether it could be applied in such a way as to increase the strength of the structure. This had been found to be the case in the test pieces made. It would be possible to finish off new work with a cover of Gunite, but he thought it would be quite unnecessary. If a good concrete was used and was properly placed, there was no need for any extra cover. Gunite, although effective, was expensive, and it cost from 6d. to 2s. 6d. per superficial foot to repair with this material, according to the accessibility. When a structure had deteriorated it was not usually necessary to repair the whole of the surface, and he had found that in the worst instance at Windsor Street it was only necessary to treat about one-third of the surface. The structures concerned were a necessary part of the works manufacture, and to have maintained continuity of carbonizing and also rebuild the plant would have been most costly and difficult. Repair by Gunite, in these circumstances, represented a considerable economy.

In order to expedite the work it was usual to use a rapid hardening cement. When Gunite was placed, it was advantageous that the initial setting should take place in good time so that the surface could be screeded and the job finished. Screeding must be done just at the right time before final setting.

Water required for the hydration of the cement was included in the Gunite when placed, and the amount of water was only just sufficient for hydration or just a little more, whereas with ordinary concrete an excess of water had to be used in order to manipulate.

The foundations of the structures were not reinforced and were perfectly satisfactory. Corrosion of the internal steel work had caused the trouble, and this was due to infiltration of air and liquids owing to the way in which the original work had been carried out. The steel was cleaned when repairs were executed, and if necessary concrete cut away to allow thorough cleaning. The materials used in the original structure were all tested at the time and no reason was found to suppose that any bad material was included. Most of the trouble had been due to mechanical causes. He was of opinion that Gunite would make an excellent lining for tanks, though he had never used it for that purpose. He had used it for lining coke hoppers with great success and knew of many instances where it had been successfully used for lining steel chimneys.

No hair cracks had appeared on the surface of the repairs after five years.

The advantage of Gunite was that not only was it placed immediately but it contained a minimum amount of water, and the fact that there was so little water to dry out was one of the reasons for the strength of the material. The Gunite system was the only method by which deteriorated concrete could be built up. Ordinary mixtures placed on old surfaces did not properly adhere.

THE CONTROL OF A
Carburetted Water Gas Plant

by
F. J. DENT, Ph.D.

In a Paper before the London and Southern District Junior Gas Association on Feb. 14, Dr. Dent discussed the significance of the tests on water gas recently made by the Joint Research Committee of the Institution and the University of Leeds, with particular regard to the application of the results to everyday plant control.

It is emphasized immediately that the following Paper will not propose that the proper control of a plant depends upon making an elaborate system of observations. These are not required. Proper control depends more upon an intelligent appreciation of the influence of various plant conditions upon the working of the process.

The suggestion that benefit may be obtained from an investigation and discussion of the principles of a process some sixty years old may appear audacious, in view of the knowledge which has accumulated in that time; but it was felt that there was an incomplete welding of the experimental data collected by chemists to the experiences of engineers—to the disadvantage of both. Different opinions are still expressed upon some of the most fundamental factors involved in the water gas process, and it was thought that these were due in many cases either to the opinions being based upon the translation of the results of laboratory investigations to large scale practice—always very difficult because of the large number of factors involved—or to drawing conclusions from large scale tests on the influence of individual factors with other factors standardized.

The Joint Research Committee believed that the position might be elucidated by a wider survey of the influence of plant conditions on performance than has hitherto been carried out, and, accordingly, they made the series of tests described in detail in their 37th Report*. The following account summarizes the main conclusions reached.

It was inevitable that many of the conclusions to be drawn from this survey were already known, at least qualitatively, but the aim of the tests was rather to show the quantitative influence of the factors investigated and to demonstrate in this way their relative importance.

The results are considered from the economic standpoint—some attention being paid to all the items of cost entering into gas production. Assessing the results on the basis of thermal efficiency, as in previous reports, was not suited to the present purpose. Determinations of thermal efficiencies and the construction of heat balances have been valuable in showing where sources of loss occur in the use of raw materials, but their failure to take account of the output obtained and to distinguish between heat units of different monetary value—such as those in coke, oil, and steam—place limitations upon them.

The discussion of the test results is made in view of the data set out in Table 1. The figures in this table indicate, first, that the cost of the raw materials forms only half the total cost. They also show the high cost of oil relative to that of coke—but, of especial interest, they bring out the relative importance of capital charges. Per therm of gas made, these are considerably higher than the total expenditure in generator fuel.

TABLE 1.—*The Cost of C.W.G. Production—Modern Automatic Plant—when making Gas of 450 B.Th.U. per Cu.Ft.*

	Pence per Therm.
Raw materials—	
Oil (4d. per gallon)	1·34
Coke (20s. per ton)	0·71
Operating labour	0·35
Wear and tear	0·33
Capital charges	1·26
Total	3·99

The table has been constructed from data given by Messrs. Humphreys and Glasgow for a peak-load plant in their brochure "Carburetted Water Gas as a Coal Gas Auxiliary." It should be mentioned, however, that the value of the items for raw materials and operating labour have been obtained by splitting up a single item given in the brochure for the "manufacturing cost less wear and tear," use being made of typical values for oil and coke consumptions. Thus, the figure for "operating labour" should not be taken as authoritative.

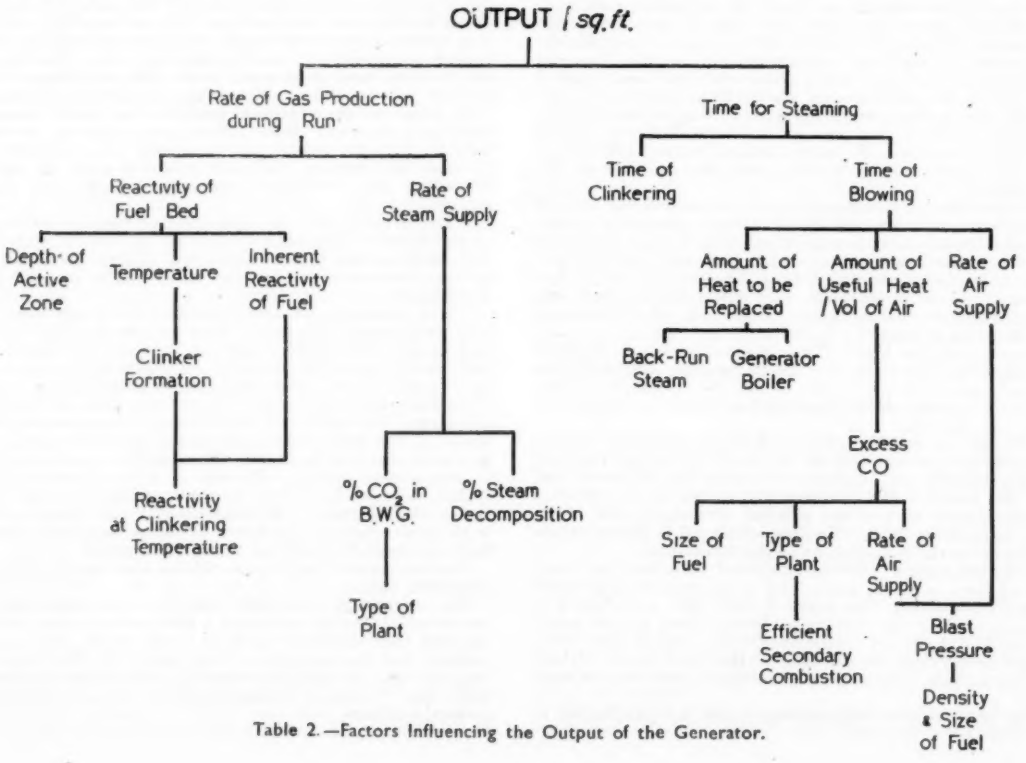


Table 2.—Factors Influencing the Output of the Generator.

* Trans. Inst. Gas Engrs., 1935-36.

The capital charges accepted per therm, at the installation of, say, a number of units to supply a given load, can be taken as varying inversely as the output obtained from each unit. On this basis the figures in Table 1 indicate that, when making gas of 450 B.Th.U. per cu.ft., the savings in capital charges effected by increasing the output by 10% are equivalent to:

An increase of 17% in the yield of B.W.G. obtained from the coke.

An increase of 10% in the yield of oil gas obtained from the oil.

Or a reduction of 19 in the percentage of inerts in the B.W.G.

The important significance of this relationship depends upon the fact that while obtaining a high output in order to reduce the capital charges impairs the conditions desirable for steam and oil decomposition, the influence of the capital charges is so marked as to warrant considerable sacrifices in those for raw materials, in so far as these are unavoidable. For example, in one series of tests the output was increased by extending the time used as the blow period—a method which, under the conditions of the experiments, led to a considerable reduction in the yield of B.W.G. obtained from the coke. While the output of the generator was being raised from 300 to 380 therms per hour the yield from the coke fell from 88 to 70 therms B.W.G. per 1,000 lb. The reduction of capital charges per therm, however, more than counterbalanced the increased expenditure in coke, up to a blow period of 44%, and the increase in the sum of the two charges at 48% was inappreciable.

One arrives at the conclusion that obtaining a high output is so important that the optimum conditions for operating a water gas plant should be regarded as those which raise the output until the consequent reduction of capital and, to some extent, labour charges are just counterbalanced by the increase in the cost of raw materials—as distinct from the view that operation should be adjusted so as to obtain the greatest yields from the raw materials.

Accordingly, deducing the conditions which lead to a high output forms the logical starting point for the analysis of the process. Table 2 is a guide to an analysis made along such lines. It should be noted that the table only applies to the generator, and it is assumed that the carburettor and superheater will always be of adequate capacity for enriching purposes. It is seen, first, that the output of the generator is governed by the rate of blue gas production during the run and the time available for steaming. The rate of gas production is then shown as depending upon the reactivity of the fuel bed—or its capacity for steam decomposition—and upon the rate of steam supply. In turn, the reactivity of the bed is determined by the depth of its active zone, the temperature of its active zone, and the inherent reactivity of the fuel—as, for example, is measured at a standard temperature in the laboratory. Now the depth of the active zone is fixed primarily by the total depth of the fuel bed, and if this is too shallow there is insufficient opportunity for the cold coke charged to the top of the generator to be raised to reaction temperature by the heat of the hot gases flowing upwards through the bed. Cooler coke descends lower down the generator and there absorbs heat which would otherwise remain for steam decomposition. Table 3 gives test results showing how the rate of gas production during the run decreased as the fuel depth was lowered from 6·0 to 3·5 ft.

TABLE 3.—*The Effect of the Depth of the Fuel Bed on the Rate of Gas Production during the Run Period.*

Depth of fuel bed, ft.	6·0	4·75	3·5
CO_2 in B.W.G., %	5·0	5·1	4·9
Rate of gas production during run, therms/minute/sq.ft.	0·167	0·149	0·143

The depth of the active zone also depends upon the size of the fuel, but this factor has more important influences in other directions.

The dependence of the reactivity of a fuel bed on its temperature is well appreciated. More rapid clinker formation, however, places an upper limit on the temperature which can be maintained. It is interesting to note here that, on a self-clinkering plant, the symptoms of excessive clinker formation were an increase in the percentage of carbon monoxide in the blow gas and an increase in the temperature at which the gases left the generator. These effects, both of which increased the loss of heat in the gases leaving the generator, made their appearance before any pronounced difficulty was encountered in the extraction of the clinker by the grate. The increased loss of heat from the generator materially reduced the output. Thus it can be taken that obtaining the full output from the plant requires a high temperature in the fuel bed, but excessive clinker formation must be avoided. Benefit will clearly be obtained if the ash in the fuel used has a high fusion temperature, and a similar benefit will follow if the fuel has a high inherent reactivity. From this point of view the property desirable in a fuel for water gas manufacture is a high reactivity at its clinkering temperature.

With a fuel bed of given reactivity, the rate of gas production during the run is determined by the rate at which steam is supplied (see Table 2), but the gain in output is accompanied by a less proportion of the steam being decomposed and also a deterioration in the quality of the blue water gas. The relationship between these changes, as observed on the plant tested, is shown in Table 4, the data corresponding, as far as could be ascertained, to operation with the fuel bed at a given reactivity.

TABLE 4.—*The Relationship between the Rate of Gas Production, the Percentage Decomposition of the Steam, and the Percentage of Carbon Dioxide in the B.W.G.*

Rate of B.W.G. Production during Run Periods. Therms per Min. per Sq.Ft.	Steam to Generator Decomposed, %.	Carbon Dioxide in B.W.G., %.
0·148	52·5	4
0·178	48·5	5
0·197	44·9	6
0·212	42·3	7
0·226	39·4	8

The cost of steam is small compared with the reduction of capital charges resulting from the increase in the rate of gas production and the greater steam consumption, due to a smaller percentage of it being decomposed, is of little consequence. It is consideration for the increase in the percentage of carbon dioxide in the gas made which fixes an upper limit upon the rate at which steam is supplied. The highest percentage of carbon dioxide permitted in the gas is often 5%, but the data given above indicate that this figure is rather low. It appears that 7-8% of carbon dioxide can be allowed before the cost of the additional oil required for enrichment balances the reduction of capital charges possible by an increased rate of gas production. It should be noted, however, that the rate of steam supply at which the limiting percentage of carbon dioxide is obtained in the blue water gas varies considerably on plants of different type—self-clinkering plants showing a marked advantage in this respect. This point is illustrated by Table 5, in which the data applying to the hand clinkered set have been taken from the recent book on water gas by Hollings and Griffith. As would be anticipated, the greater rate of steam supply on the self-clinkering set led to a low percentage of it being decomposed. The interesting feature is, however, that the carbon dioxide in the B.W.G. was not excessively high in spite of the presence of the larger amounts of undecomposed steam.

TABLE 5.—*The Rates of Steam Supply and the Qualities of the Gas Produced on Hand Clinkered and Self Clinkering Plants.*

—	Hand-Clinkered.	Self-Clinkering.
CO_2 in B.W.G., %	6·6	6·1
Rate of steam supply, lb per min. of run period per sq.ft.	1·21	4·06
Rate of B.W.G. production, therms per min. of run period per sq.ft.	0·1035	0·2107
Steam decomposed, %.	71	41

The proportion of time used for steaming (see Table 2) depends upon how much time is occupied by blowing, clinkering, &c. The elimination of stoppages for clinkering in automatic plants is an obvious saving. There remains the time needed to generate the heat required for steam and oil decomposition by blowing. This is shown as being determined by three items, viz:

The amount of heat to be replaced.

The amount of useful heat generated per volume of air.

The rate at which air is supplied.

Taking these items in turn, the amount of heat to be replaced includes that necessarily absorbed in the reactions between steam and coke and in those occurring at the decomposition of the oil. As shown in Table 6 these absorp-

tions are increased by the sensible heat carried away by the carburetted gas, tar vapours, and undecomposed steam, the heat which passes to the generator boiler and the losses by radiation, &c.

TABLE 6.—*The Amount of Heat to be Replaced by Blowing when Making C.W.G. of 450 B.Th.U. per Cu.Ft.*

—	Therms per Therm B.W.G.
Heat absorbed by the steam coke reactions	0·21
Heat absorbed by the decomposition of the oil	0·02
Sensible heat of C.W.G. and tar vapours	0·13
Heat carried away by undecomposed steam	0·05
Heat absorbed by the generator boiler	0·10
Heat lost by radiation, &c.	0·05
	0·56

The most effective way to minimize the total heat absorption and so obtain an increase of output is to reduce the amount of sensible heat carried away by the C.W.G., tar vapours, and undecomposed steam by using back-run steaming. A gain in output of 10% can be expected as a result of the lower temperatures at which gases then leave the top of the superheater, combined with the influence of passing the back-run gases directly to the wash box.

A difference of opinion exists as to how far this advantage, and that of a lower coke consumption which is also secured, are counterbalanced by the necessity of using higher rates of oil supply with back-run steaming—especially when making C.W.G. of high calorific value. In this regard, tests made by the Joint Research Committee on a plant equipped with an annular boiler indicated that the deleterious influence of the greater rate of oil supply on oil efficiency was counterbalanced by improved evaporation of the oil from the top of the carburettor. It appears that back-run steaming is particularly suited to plants with annular boilers.

Apparent Disadvantage of Annular Boiler.

Table 6 indicates that the inclusion of an annular boiler introduces a considerable disadvantage by increasing the amount of heat to be replaced during the blow period. Actually, however, the apparent disadvantage does not materialize for reasons which arise in connection with the second item determining the time occupied by blowing—viz., the amount of useful heat liberated per volume of air supplied. This amount should clearly be as high as possible, and increasing it depends upon reducing the losses of heat which occur during the blow period. Once the losses of sensible heat have been minimized by adoption of the back-run, further gains in this direction rest mainly with the elimination of carbon monoxide in the blow gases in excess of that required for maintaining the temperature of the carburettor and superheater.

The importance of avoiding the production of excess carbon monoxide because of its influence on both output and coke consumption is so well appreciated that emphasis here is unnecessary. Controlling carbon monoxide formation according to requirements without sacrificing the capacity of the fuel bed for steam decomposition, involves much of the art of water gas manufacture. One must exercise to the full those factors which affect carbon monoxide during the blow without prejudicing the steam reactions of the run. Such factors include the size of fuel, the type of generator, and the rate of air supply used in blowing.

Table 7 illustrates the influence of the size of the fuel. It shows that, when conditions are regulated so that B.W.G. of a given quality is prepared during the run, a condition to be associated with obtaining the maximum output, carbon monoxide formation is greater when using coke of small size. The effect is attributed to combustion then occupying a shallower zone of the fuel bed.

TABLE 7.—*The Influence of the Size of the Fuel on Carbon Monoxide Formation.*

—	>3 In.: 25%. 3–2 In.: 50 .. 2–1½ In.: 25 ..	>1½ In.: 10%. 1½–1½ In.: 40 .. 1½–1 In.: 50 ..	1½–1 In.: 90%. 1 – ½ In.: 10 ..	1–½ In : 92%. ½ In.: 3 .
CO_2 in B.W.G., %	5·3	5·3	5·3	5·3
Steam decomposed, %	47·1	47·5	49·4	42·4
CO in blow gas, %	9·2	12·2	14·1	18·4

The type of plant is also of considerable importance, and the available results indicate that carbon monoxide is more likely to be excessive on hand clinkered plants. This difference between hand-clinkered and self-clinkering sets is shown in Table 8, in which the example applying to hand-clinkering is taken from Hollings and Griffith as before.

TABLE 8.—*Hand-Clinkered and Self Clinkered Sets.*

—	Hand-Clinkered.	Self-Clinkering.
Carbon dioxide in B.W.G., %	6·6	6·1
Rate of B.W.G. production, therms per min. of run period, per sq.ft.	0·1035	0·2107
Blast pressure, in. w.g.	18	21
Rate of air supply, cu.ft. per min. of blow period, per sq.ft.	136	165·5
Carbon monoxide in blow gas, %	13·6	9·9
Temperature of blow gas, ° C.	725	635
Therms B.W.G. per 1,000 lb. of coke, 10% inerts	80·4	83·2
Make B.W.G. per hour, therms per sq ft.	4·32	7·08

On a given type of plant, however, it is choice of the rate of air supply during the blow period which provides most control over carbon monoxide production. This influence of the rate of air supply is apparent in Table 9.

TABLE 9.—*The Influence of the Rate of Air Supply on Carbon Monoxide Formation.*

The rate of air supply, cu.ft. per min of blow period, per sq.ft.	80	172
Average rate of steam supply, lb. per min. of run period, per sq.ft.	1·72	2·03
Steam decomposition, %	39·5	43·7
CO_2 in B.W.G., %	6·1	4·9
CO in blow gas, %	11·4	8·8

In comparing the figures given, it will be seen that those for the rate of supply of steam and for its percentage decomposition show that the reactivity of the fuel bed was rather higher in the test when the greater rate of air supply was used, the blow period being relatively longer in that case. In spite of this, however, the blow gas contained a smaller percentage of carbon monoxide. It can be taken that the difference in this item would have been larger if the test conditions had been comparable in other respects.

Thus, with a greater rate of air supply, there is more time available for steaming, for two reasons—first, because of the direct reduction of time required for the supply of a given volume of air, and, secondly, as a result of there being small heat losses from the plant (see Table 2). The rate of air supply should be as high as possible, the "ideal" blast pressure being that with which just sufficient carbon monoxide is produced to maintain the carburettor and superheater at the desired temperatures. This ideal may or may not be attained, depending upon whether the excess carbon monoxide is eliminated before the rate of air supply reaches the limit fixed by the tendency of the fuel to be blown from the generator. There will clearly be greater opportunity for preventing excess carbon monoxide when the fuel used is large and dense, and it is in this connection that these characteristics in a fuel show their greatest advantages.

Output and Coke Consumption.

Consideration of the elimination of excess carbon monoxide is intimately connected with the relationship between output and coke consumption. As you probably know, the amount of carbon which is gasified in steam in the production of one therm of B.W.G. always approximates very closely to 4·86 lb., and variations in the total carbon consumption depend upon changes in the amounts burnt during the blow period and those lost in the ashes, clinkers, and fliers. The losses in ashes, clinkers, and fliers are small compared with the amount burnt in liberating the heat required for steam and oil decomposition, and it is usually variations in this last amount which account for any appreciable variations in the total coke consumption. From this it follows that the conditions which are most favourable to a high output will also lead to a low coke consumption, since the quantity of coke burnt will be less, the smaller is the amount of heat to be replaced, and the greater the proportion of the heat liberated which is usefully applied—this proportion increasing with the amount of heat usefully liberated per 1,000 cu.ft. of air. Thus the coke consumption diminishes when the losses of sensible heat are reduced by back-run steaming and when losses of potential heat are eliminated by increasing the rate of air supply. We therefore arrive at the important conclusion that operating a plant at high output does not involve any sacrifice in the yield of B.W.G. from the coke, so long as the rate of air supply can be increased so as to avoid excess carbon monoxide production. Only when the limits imposed by the tendency of the fuel to leave the generator have been reached does consideration for the coke consumption enter

as a factor determining the most economical output for the operation of a plant.

Our tests at Croydon did not enable us to come to a final conclusion on the probability of meeting this restriction due to the fuel under the various conditions prevailing in practice. Owing to the equipment of the plant tested, it was impossible to increase the blast pressure above that normally used—namely, 21 in.—at the generator base. The rate of air supply obtained with this blast pressure was not sufficient to avoid completely the production of excess carbon monoxide when the temperature of the fuel bed was increased to what appeared to be a reasonable limit from the point of view of clinker formation and wear and tear of the grate. On the other hand, there were no signs of the amount of material carried over from the generator becoming excessive—the fuel used being coke from Durham coal carbonized in intermittent chambers and horizontal retorts. The impression was gained that the fuel would permit a sufficient increase in the blast pressure to enable the use of the limit of temperatures in the fuel bed—with benefits in steam decomposition—without serious loss of carbon monoxide in the blow gases, and hence without serious increase in the coke consumption.

Hand-Clinkered Plants.

The position on hand-clinkered plants appears to be rather different. In this case, carbon monoxide production is much more pronounced at any given rate of air supply—or, conversely, a higher blast pressure is required to reduce the carbon monoxide production to a given amount. Thus the limitations due to the density of the fuel are more likely to be reached on this type of plant, and obtaining the most economical output is often accompanied by some loss of carbon monoxide, and accordingly some increase in the coke consumption. This is certainly the case at present, since the blast pressures employed on hand-clinkered plants are generally below rather than above those used on self-clinkering plants. It is due to this fact that the introduction of the generator boiler has not led to the increase in coke consumption which might have been anticipated.

It appears probable that the superiority of the fuel bed conditions on the self-clinkering plant, both as regards the greater capacity for steam decomposition during the run and the reduction of carbon monoxide formation during the blow, are the combined influence of a number of factors. These will include the absence of clinker accumulations, a more suitable distribution of temperature in the fuel bed resulting from the use of a greater proportion of down steam and the presence of the generator boiler itself.

In the examples quoted, the difference in the performances obtained in the generators of hand-clinkered and self-clinkering plants are very marked. Sometimes, however, this is less so, and it may be observed that the superiority of the fuel bed condition of the self-clinkering plant used in the test described in the 27th Report of the Joint Research Committee was not so pronounced. Personally, I have not encountered a complete explanation of these differences between the behaviour of one plant and another, and the matter appears to be of such importance as to warrant investigation.

Whatever is responsible for the improved fuel bed conditions on self-clinkering plants, however, the fact that they are obtained affects the working of these plants in a way which should be appreciated. When less heat leaves the generator in blow gases it becomes more difficult to maintain the desired temperature in the carburettor and superheater; especially does it become more difficult to store sufficient heat at the top of the carburettor, the point where the greatest absorption occurs during the enrichment of the blue gas. With less heat available, securing complete evaporation of the oil requires a greater proportion of the heat to be liberated at the top of the carburettor and, hence, a more rapid admixture of the secondary air. It was found that the practice of supplying secondary air at a point through the shell of the carburettor did not give the rapid mixing desirable, and the more recent system, in which the secondary air enters through a number of points round the generator-carburettor main proved to be much more satisfactory.

This brief analysis of the working of a water gas generator is by no means complete, but it attempts to bring out the nature of the compromises which are to be made in deciding upon the most economical conditions for operation. The analysis can be summed up in the statement that the performance obtained from a plant depends upon a number of factors, such as the properties of the fuel used, the design of the plant, depth of fuel bed, and to these can be added gas leakage, the length of the cycle, &c. These various factors should receive individual attention; but, finally, one must decide upon the percentage of carbon dioxide to be permitted in the blue water gas, for this ultimately determines the rate of steam supply, and then, under circumstances in which the blast pressure cannot be raised sufficiently to avoid excess carbon monoxide, one must also decide how far a greater output warrants a sacrifice in the coke consumption.

A Logical Basis for Review.

These considerations afford a logical basis for reviewing the performances obtained from a plant to see whether its operating conditions lead to the minimum possible cost of gas production. They also indicate the method in which the optimum operating conditions can be obtained. Thus, first the rate of steam supply should be adjusted so that the percentage of carbon dioxide in the gas made has risen to the maximum to be permitted. Then the proportions of the cycle used as blow and run periods should be chosen so that there is just sufficient carbon monoxide in the blow gases to meet carburetting requirements. Next, the rate of air supply should be progressively increased through the blast pressure, the percentage of carbon dioxide being maintained at the limit throughout these operations by adjustment of the rate of steam supply. It will be realized that when the blast pressure is so increased, other conditions are such that the temperature of the fuel bed will rise. This is apparent from the following considerations. A higher rate of air supply increases the volume of air supplied per blow in direct proportion, and will require some corresponding increase in the amount of steam used per run and, hence, a higher rate of steam supply. Therefore, the final adjustment of the relative amount of steam to that of the air must be to give a higher temperature, since the quality of the B.W.G. is maintained at a higher rate of steam supply.

Thus, according to circumstances, the progressive increase of the blast pressure will finally be limited either by excessive clinker formation or by the tendency of fuel to be blown from the generator. In the former case, the operating conditions will have then reached the optimum, but in the latter, where the highest temperatures permitted by the fuel have not yet been attained, a further increase in output can be obtained with advantage by lengthening the blow period—admitting the steam at a higher rate during the shorter run. This process will increase the temperatures in the fuel bed and, since the rate of air supply remains unaltered, will give rise to the production of excess CO. Less useful heat will be liberated from a given volume of air, and there will be a reduction in the thermal yield of gas from the coke. Thus, the procedure will eventually be limited by either excessive clinker formation or by no further increase in output being obtained, or by consideration for the coke consumption.

Realizing that the total charges for gas production on a given plant are lowest under conditions involving sacrifices in the use of raw materials, and that the rated capacity of a plant which governs its installation will correspond to such conditions, it follows that, after installation, it will be possible to reduce the charges for raw materials per therm if operation is modified at those times when the full output of the plant is not required. The suggestion is made that, in operating a water gas plant to supply a fluctuating demand for gas, three or four sets of operating conditions should be standardized and used according to the variations in demand, particularly according to the seasonal variations which are known with some certainty.

Minimum Sacrifice of Raw Material.

The procedure to be adopted in modifying the operating conditions for this purpose will be clear from the previous discussion which has pointed out the manner in which the sacrifices in raw materials were incurred in the reverse process of obtaining a high output. The 37th Report discusses the conditions for operating under reduced output in more detail than is possible here, but, briefly, they are based upon the following considerations. In the case where it has been possible to avoid excess CO production at full output, the savings to be gained lie in the direction of improving gas quality, increasing percentage steam decomposition, and probably obtaining a higher yield of oil gas from the oil if the full output has extended the capacity of the carburettor and superheater. When the full output is not required, all these savings are best secured by shortening the blow period, admitting the steam and oil at slower rates over the longer run. To obtain the greatest benefit a high reactivity should be retained in the fuel bed, and so the rate of steam supply should be reduced sufficiently to maintain the temperature in the fuel bed at the maximum permitted by clinker formation.

In the other case, in which excess carbon monoxide has not been avoided at the full output, there is the further possibility of a saving in coke consumption. Securing this saving clearly depends upon operating with a fuel bed of less reactivity—to be obtained by lowering its temperature. This is achieved by shortening the blow period as before, but then adjusting the steam supply so that the

quality of the blue gas remains the same as that permitted at the full output. With the slower rate of steam admission during the longer run period, maintaining the same quality in the blue gas will result in a lower temperature in the fuel bed.

It will be clear that so long as plant operation is adjusted to reduce coke consumption in this way improvements in gas quality and steam decomposition are not obtained, and, moreover, the amount of heat available in the waste gases for steam raising decreases. Unless cheap surplus steam is available from sources external to the plant, it will probably be most economical to reduce the temperature of the fuel bed only to that which leaves sufficient carbon monoxide in the waste gases to raise the steam requirements of the plant, and then to obtain further savings by improving the quality of the gas and the decomposition of the steam.

From this description it appears that the two observations which are most significant for the control of the plant are the percentage of carbon dioxide in the water gas made and the percentage of carbon monoxide in the waste gases leaving the superheater. It is customary to make routine measurements of the first of these, but I would like to close by emphasizing the value of determining the amount of excess carbon monoxide produced. Indeed, it is difficult to imagine the intelligent supervision of a water gas plant without this determination.

Discussion.

The PRESIDENT (Mr. J. M. Webber, of Croydon), before opening the discussion, apologized for the absence of Mr. W. Grogono (Engineer to the Croydon Gas Company) who had been prevented at the last moment from being with them on that occasion. Continuing, Mr. Webber said that until quite recently the water gas process had seemed to be surrounded by a great deal of mystery. How much this was due to a lack of exact information and how much to failure to make known facts public he could not say; but he remembered that twelve years or so ago he tried to find out what information was available on the subject, and he had been very surprised at the almost complete absence not only of information but of the demand for that knowledge.

The Gas Industry as a whole was deeply indebted to The Institution of Gas Engineers and to Dr. Dent for the immense amount of work they had done in this direction, and, thanks to them, the Industry now had as much information available about water gas as about any other process they employed. He expected that most of the members were aware that much of Dr. Dent's work had been carried out at Croydon, and that Company were proud that they had been able to play a part in this research.

Perhaps the most valuable feature of Dr. Dent's reports was the attention he had given to costs and the light he had thrown on this aspect of the subject. The whole subject of costing water gas production was an extraordinarily complex business, and much ink had been spilled in dealing with it. Mr. Webber emphasized that the one thing that mattered in gas production was the cost of mixed gas into holder and the ability to meet all demands made by the district. He could not help feeling that there might be a tendency, after giving detailed consideration to costs of water gas, to strive after cheap water gas production, which was very easily obtained, and to forget that no reduction in the cost of a water gas therm could be permitted if such a reduction entailed a rise in the cost of the therm of mixed gas. In the case of Croydon, for example, where they had a plant which was normally working at quite a low load factor, they could effect a large reduction in the cost of the water gas therm by increasing their percentage of water gas; but they knew beyond all doubt that, under the conditions of to-day, this would at once increase the cost of their mixed gas. The various plants on a modern gas-works were so linked together that no single unit could be treated on its own merits; but each must be worked so that the organization as a whole was working at the most profitable point.

Dr. DENT, acknowledging Mr. Webber's appreciative remarks, was in agreement with the opinion that primary importance must be attached to the cost of mixed gas production. To reduce this cost to a minimum it was plainly essential to know of the various factors which influence the cost of production of each of the constituent gases and the experimental work under discussion was carried out on the factors entering into the manufacture of one of the constituents—viz., water gas. The importance of reducing the capital charges per therm, a principal conclusion reached, had particular regard to the auxiliary nature of the part played by water gas in mixed gas production.

Importance of Economic Use of Materials.

Mr. H. H. BROWN (Southampton) remarked that their President was to be congratulated upon inducing Dr. Dent to lecture to them on this particular subject. He then went on to recall Mr. Webber's reference to Dr. Dent's 100% efficient performance in "taking the rabbit from the hat," *vide* discussion of the 37th Report. Mr. Brown was of the opinion that Engineers would agree that consideration of the factors relating to economic use of materials from which the component gases were produced was very important. This meant to say that any consideration of the process of carburetted gas as a whole must take into account the relative efficiency of the blue gas obtained in relation to the coke and the oil gas efficiency and enriching value in relation to oil. Dr. Dent had obtained results many Gas Engineers thought highly satisfactory, and at the same time had demonstrated that if efficiency and economy were to walk hand in hand they must have very elastic arms!

Although Dr. Dent had shown efficiency in terms of component raw materials, he always referred to coke consumption relative to blue gas and not in the mistaken way adopted in some quarters to the total gas—he did not lose sight of the fact that the process must be judged economically as a whole, and it might be advisable to work at a lower efficiency in order to obtain greater economy. He would like, while on the subject of blue water gas, to ask a question regarding the calculation of the blue gas therms per 1,000 cu.ft. of carburetted water gas, for he had been at some pains to simplify a rational method of calculating this; but he was curious to know Dr. Dent's method. On reference to the 31st Report, when applying his method of calculation, he had obtained figures which when taking into account the hydrogen absorbed by the oil cracking process and the excess hydrogen resulting from ash reaction, were only 2% less than the figures which Dr. Dent had given. He took it that Dr. Dent's figure included the carbon monoxide in the purge gas?

Another point, continued Mr. Brown, was the value of the oil in carburetting. It was quite conceivable that one could obtain a high efficiency in therms per gallon and yet have a relatively small elevating effect on the calorific value of the mixed gas. He found that on hand-operated sets it was in keeping with good practice to increase the oil throughput at the commencement of the run when the carburettor heat was sufficient to deal with the oil vapours at a very high rate and still to obtain a high yield of therms per gallon. Dr. Dent had shown that in order to obtain cheap therms of water gas it was not always necessary to work the plant at full capacity. On the other hand, no loss of blue gas therms occurred through over-steaming because the amount of carbon reacting with the steam was practically constant per therm of blue gas, and the cost of steam, especially when the set incorporated an annular as well as waste-heat boiler, was relatively low. There came a time, however, when it might be possible to work a plant at a lower rate than normal and because of certain conditions of labour available and production demands, under these circumstances, to improve the efficiency of the process in terms of the raw material.

Capital Charges Remain.

Whether they liked it or not the capital charges on the plant remained, and it was often better to work at a lower air/steam ratio than work it less efficiently at higher rates for intermittent periods. He had found this to be the case on hand-clinkered sets, and it had been borne out at Southampton when they had been using little oil or had for long periods been making blue gas. The statements Dr. Dent had made respecting this type of plant had been demonstrated very clearly in many other respects. As regards the necessity for analyzing the blow gas at the outlet of the superheater, he was in complete agreement; but it had been shown at Southampton by a series of tests that when making low quality gas it was only necessary to obtain figures for carbon dioxide and deduce from this the amount of carbon monoxide present by a simple calculation.

He gave this method which was to assume the percentage of carbon monoxide to be equal to one-third of the difference between 105 and five times the percentage of carbon dioxide:

$$CO = \frac{105 - 5\,CO_2}{3}$$

Mr. Brown went on to explain the basis of the formula used by him to calculate the thermal equivalent of blue gas per 1,000 cu.ft. of carburetted water gas, and invited Dr. Dent's views thereon.

The formula was given as:

Blue gas therms per 1,000 cu.ft. of C.W.G.

$$= 0{\cdot}0638 \left[CO + CO_2 + 1 - \frac{N_2 - 4\,O_2}{3{\cdot}77}\right]$$

Where CO, CO_2, N_2, and O_2 represent the percentage by volume of the respective gases in the C.W.G.,

$N_2 - 4\,O_2$ represents the nitrogen in purge gases.

The basis of the formula is as follows:

On the assumption that the mixed CO and H_2 have a calorific value of 319 B Th U. per cu.ft.

Therms due to CO . .	$= 0{\cdot}0319\,CO$
Therms due to H_2 being equivalent to an equal volume of CO originally present in blue gas	$= 0{\cdot}0319\,[CO - 0{\cdot}13\,(N_2 - 4\,O_2)]$
Plus twice the equivalent volume of CO_2 originally present in the blue gas .	$= 0{\cdot}0319\,[2\,[CO_2 - 0{\cdot}2\,(N_2 - 4\,O_2)]]$
Therms due to CH_4 . on the assumption that the methane in the blue gas due to hydrogen in coke = 0·3%	$= 0{\cdot}03$
Therms due to excess H_2 on the assumption that the ash reaction gives an increased volume of H_2 by 1·056%.	$= 0{\cdot}0338$

Total therms in blue gas

$= 0{\cdot}0638\,[CO + CO_2 - 0{\cdot}265\,(N_2 - 4\,O_2)]$ *plus* 0·0638.

$= 0{\cdot}0638 \left[CO + CO_2 + 1 - \frac{N_2 - 4\,O_2}{3{\cdot}77}\right]$

Pexton's Method.

Dr. DENT replied that it was gratifying to come across anyone who has been in everyday control of water gas plant whose ideas were so much in agreement with his own. The therms of blue water gas per 1,000 cu.ft. carburetted water gas were calculated as follows: Taking an analysis of the carburetted water gas, first, the oil gas constituents were separated using Pexton's method which allows for the absorption of hydrogen during carburetting. At the same time, account was taken of the hydrogen present in the coke used, and 0·3% of methane in the blue water gas, and of the hydrogen contained by the hydrogen sulphide removed in purification. Then the amounts of oxygen and nitrogen due to the air admitted for purification were subtracted. Finally, the excess of the remaining nitrogen above that which can be ascribed to the nitrogen in the coke, was taken as arising from included blow gas and as being accompanied by corresponding amounts of carbon monoxide and dioxide. Here it was assumed that the included blow gas had the same composition as an average sample of blow gas. The refinement suggested by Mr. Brown was not used in view of the uncertainty of the relative amounts of blow gas included at the beginning and end of the run period and also because of the neglect of the influence of cyclic oxidations and reductions of the ash on the hydrogen content of the gas made. On the other hand, Dr. Dent considered that the expression derived by Mr. Brown for the therms B.W.G. per 1,000 cu.ft. C.W.G. was fully justified and it should prove valuable in analysing water gas results.

Dr. Dent was interested in Mr. Brown's experience that better oil cracking was obtained when the period of oil injection was restricted towards the front end of the run period. He had encountered the same experience in the down-run tests described in the 31st Report of the Joint Research Committee. Dr. Dent was now of the opinion, however, that the inability to maintain the desired temperature at the top of the carburettor was mainly due to incomplete mixing of the blow gas and secondary air at that point. When proper mixing was obtained it should be possible to make full use of the time available for oil injection.

With regard to analysing the waste gases, it should be noted that, while the determination of the carbon dioxide might be sufficient for routine purposes, it should not be regarded as giving an indication of the percentages of oxygen and carbon monoxide on the basis that the sum of the free and combined oxygen was equivalent to 20·9—the percentage of oxygen in the air supplied. Such an assumption led to error because of the combustion of residues from the oil left on the chequerbricks. Such residues contained hydrogen and their combustion depressed the oxygen equivalent of the waste gases, sometimes to as low a figure as 20·2.

Not a True Picture of Capital Charges.

Mr. J. GRAYSTON (Lea Bridge) suggested that Dr. Dent had not given a true picture of the capital charges of the water gas process as they affected the balance-sheet of the gas undertaking. He had dealt with the capital charges of the plant operating under optimum conditions; but no gas undertaking would ever operate their works under such conditions. The amount of capital spent on water gas plant was a function of the peak load of water gas which the Engineer thought he should carry; and once that had been decided, the total capital charges on account of water gas were a fixture. Dr. Dent had unduly stressed the importance of capital charges. Given an installation which had to produce the amount of water gas which an undertaking was called upon to make under any conditions, the only controlling factor, he suggested, was economy of operation.

Dr. DENT observed that this was merely a difference of viewpoint. In considering the manufacture of water gas in the broadest sense one should begin by considering the installation of the necessary plant. Then the question arose whether it was cheaper to install, for example, three plants which would give high coke and oil efficiencies or whether one should install two plants having the same output as the three but giving a rather less yield from the raw materials. It would usually be much more economical to install the minimum number of plants and be prepared to sacrifice a certain amount of efficiency in the use of raw materials. Indeed that was the practice followed at the present time. Thus, automatic plants gave a blue water gas of very high quality, when operated at the same rate of gas production as obtained in the older type of set. One did not, however, take advantage of the fact in the normal operation of such plants. Greater benefits resulted if operation was adjusted to give blue water gas of similar quality as before but at a much higher rate of gas production.

One should get away from the view that the rated performance of a plant coincides with operating conditions giving the best yields from the raw materials. Then it would be appreciated that, when the full output was not required, it was possible to secure savings in raw materials by modifying operation.

Cost of Materials.

Mr. W. R. BRANSON (Gas Light and Coke Company) referred to the cost of materials given in Table 1. It was very often assumed that the use of additional oil in the oil gas plant involved an increase in the cost of the gas. He rather thought that, looking at those figures, this would hardly be true, because the cost of oil at 4d. per gallon one took as 1d. per therm of gas, and the total of other costs, including capital, coke, operating labour, and wear and tear, appeared to be about 1½d. per therm of blue gas; so that the oil gas per therm was cheaper than the blue gas. One might therefore conclude that it did not necessarily follow that the manufacture of a high quality gas was more costly. In fact, they could quite easily obtain additional therms at a 1d. per therm—which was cheaper than most methods of manufacture. The influence of blast pressure was emphasized in the 37th Report and again by Dr. Dent on that occasion. He asked if Dr. Dent thought that economies in production were likely as a result of designing plants to take advantage of still higher pressures. The figure of 21 in. at Croydon was fairly typical of modern practice; one was obviously limited by the clinkering tendency, but with some large and heavy fuels—and certainly fuels containing ash of a high clinkering temperature—one might be able to increase the blast pressure very considerably without difficulty from those two sources. He had experienced coke oven coke which had shown considerable economies in fuel by reason of its density and the high reactivity of the fuel bed as a whole; and by increasing the length of the blow and using a high steaming rate, it was possible to obtain higher outputs. Where such fuels were available one could adopt a considerably higher pressure.

The difference between the results in the 27th and later Reports were accounted for as much as anything by the difference in the fuels utilized. At Beckton, for instance, they had to take coke up to 2 in. in size from horizontals—and sometimes it was not even de-breezed; at other times large fuel and coke oven coke over 3 in. in size had to be used, resulting in differences in output of as much as 30%. It seemed to him that the fuel supply was a most important point in the control of operation—particularly where the fuels contained large quantities of smalls, which made it very difficult to obtain higher outputs of gas per 1,000 lb. of coke used; clinkering troubles were inclined to increase, and they had experienced a considerable amount of trouble due to the fines, which were apt to cling on to the grate and not be removed with the ash as they should be. Such conditions resulted in a dense mass which reduced the amount of air to 50 or 60% of the maximum with large fuel. The type of fuel accounted for the majority of variations in operating efficiencies between one plant and another; and it seemed to him that one must recognize that the water gas plant could hardly be debited with 20s. per ton for fuel when unsalable rubbish was being utilized.

Increasing the Assumed Output.

Dr. DENT replied that the yield of gas per gallon of oil usually approximated to 1·3 therms corresponding to 3d. per therm with oil at 4d. per gallon. As Mr. Branson pointed out, this figure for the cost per therm of oil gas was low in view of the relatively high price of oil as a raw material. The low cost was, of course, due to the possibility of increasing the degree of enrichment without special provision of plant, labour, &c. Since the calorific value of the carburetted water gas required would be fixed by considerations external to the water-gas plant, Mr. Branson's remarks really raised the question as to how far it was economical to raise the output of a plant by increasing the amount of oil used, adding inerts to obtain the desired calorific value.

Dr. Dent believed that in many cases the blast pressure could be increased with advantage above those used at the present time. This experience indicated that they had not reached the limits of the fuels available in this country, either from the point of view of their clinkering tendency or their tendency to leave the generator. Mr. Branson had also mentioned that the differences in the performance of the plant at Stratford and at Croydon might be due to the fuel used. Dr. Dent was inclined to agree with this, without being able to say definitely which properties of the fuels were responsible—they were both cokes from Durham coals, in the one case carbonized in horizontal retorts, and in the other in intermittent vertical chambers.

The tests indicated that it was difficult to justify the installation of the additional plant required if small coke (below 1 in.) was to be used when the full demand for gas occurs—even if such fuel was of low value. On the other hand, at times off the peak load, small coke could be used satisfactorily, a point which might be of value for controlling the sizes of coke available for sale.

Mr. F. O. HAWES (Tottenham) enquired what was the capacity of the plant to which Table 1 referred, and if it was a back-run plant. In regard to clinker formation from very small coke, his Company had found this to be due to a concentration of ash in the smalls. This made such a fuel unsuitable for water gas manufacture apart from any other consideration.

Dr. DENT was unable to state the output of the particular plant to which Table 1 referred. It was taken from Humphreys & Glasgow's brochure in which the size of the unit was not mentioned. It would probably correspond to a large back-run plant with an output of about two or three millions a day. Dr. Dent's observations agreed with those of Mr. Hawes that the percentage of ash in the smalls was considerably higher than in the larger fuel, but he found it possible to accommodate the greater clinkering tendency by using a more rapid grate speed.

Effect of Varying Fuel Bed Depths.

Mr. H. MOYS (Croydon) asked what were the conditions of the tests in Table 2 in regard to the varying depths of fuel and how those varying depths were utilized in practice.

Dr. DENT replied that the nature of the cycle and the quality of the blue water gas were the same throughout. The blow

period was 36½%, and the blast pressure, 21 in. thick, the adjustment of the plant to obtain a constant percentage of carbon dioxide in the blue gas was solely dependent upon the rate of steam supply during the run. In regard to the use of varying depths of fuel bed, normally the bed should be as deep as the generator would permit. The use of shallow fuel beds was only beneficial as a method of accommodating accidental variations in the size of the fuel used or in its moisture content. When the size decreased or the moisture increased, the gases leaving the top of the generator were at a lower temperature. The lower temperature, and its effect on the conditions in the carburettor, could be avoided, however, by temporarily reducing the depth of the fuel bed when such accidental variations occurred.

Vote of Thanks.

Mr. S. H. MILES (Reading), in proposing a vote of thanks to Dr. Dent for his Paper, remarked that ten or twelve years ago, as their President had stated, the carburetted water gas process was shrouded in mystery. It was penetrated by one ray of light in the shape of a Paper by Mr. Stewart; and then about ten years passed before they had another Paper on the subject. The costing of water gas processes was very difficult, and on the question of capital charges he was inclined to agree with Mr. Grayston; he could not help feeling that Dr. Dent had emphasized this point rather unduly. Two aspects of the question which were especially present in the mind of the Gas Engineer were the cost of mixed gas into holder and the satisfying of varying demands. They were rather apt to regard carburetted water gas as a sort of "very present help in trouble," and to let it go at that. The Gas Industry was very grateful to The Institution of Gas Engineers and to Dr. Dent for the wealth of information now placed at its disposal.

Mr. MOYS, in seconding the vote, referred to the extremely conscientious way in which Dr. Dent had carried out his work at Croydon. His Paper would make them keen to read the Reports on the subject which had already been presented and would thus serve an excellent purpose.

Dr. DENT briefly acknowledged the vote of thanks, which was heartily accorded, and said what a pleasure it had been to have an audience so obviously interested in the water gas process.

Carbonization Control And the Production of A High Thermal Yield

by
J. A. DERBYSHIRE,
Technical Assistant, Darwen Corporation Gas Department.

From a Paper read before members of the Manchester and District Junior Gas Association at a Meeting held at Darwen on Saturday, Feb. 8, under the Presidency of Mr. A. K. Collinge (Preston).

The plant at Darwen is the first complete installation embodying the upward heating principle of Drakes' design, consisting of four beds of a capacity of 1¼ million cu.ft. per diem, each bed containing four retorts 36 in. by 12 in. at the top, and 45 in. by 21 in. at the base, and having a nominal capacity of four tons per diem, the manipulation of all dampers and heat control being very sensitive and efficient. Each bed can be isolated into two units of two retorts or one complete unit of four retorts, and each half of the bed contains one main producer gas damper, four secondary air dampers, and one main waste gas damper, thus giving flexibility of control and heat zoning in any particular region of the retort. The gases ascend in a zigzag fashion along ten horizontal heating chambers, the last four of these being circulated by the waste gases, until at the top the gases descend into the waste gas vertical downtake via the waste gas dampers into the common main gas flue and thence to a Spencer-Bonecourt waste-heat boiler.

The main waste gas flue is lined internally with 4½-in. brickwork and 4½-in. insulation brick, the outside being encased with mild-steel plating to prevent ingress of air. Situated at the extreme end of the flue is a non-mechanical auxiliary producer with independent damper control for augmenting the temperature of the waste gases passing into the main flue. This producer is used particularly in summer time, when 25% to 50% of the plant is not working.

The waste-heat boiler is of the horizontal firetube type fitted with all accessories and driven by a 14 h.p. steam turbine so regulated as to maintain a 5/10ths pull in the main waste gas flue, this being reduced to 5/100ths pull at the top of the vertical downtake by the waste gas dampers.

Conditions at the retort mouthpiece are adjusted by means of the Arca hydraulic regulator fitted with a 14-in. butterfly valve on a 20-in. main. The vacuum at the Arca inlet is maintained at about 1½ in. To maintain this condition a minimum of 2 in. is necessary at the exhauster inlet, inasmuch as, due to the distance away from the carbonizing plant, and the effect of altitude, a vacuum loss of 4/10ths to 5/10ths is apparent.

Since May, 1933—that is, the inception of the plant—numerous coals have been tested, and it was ultimately decided to negotiate for the contracts of 7 different coals for a period of two years. The coals being equivalent to a 70% Yorkshire and 30% Lancashire mixture.

Excellent thermal yields have been obtained by quite a number of gas undertakings operating on low-grade gases of a declared calorific value of 400-425 B.Th.U. gross per cu.ft., and I should like to devote some explanation of our method of acquiring high thermal yields on a somewhat higher calorific value basis—notably 450 B.Th.U. gross per cu.ft.

Our experiences on this particular type of plant convinces us that the fundamental factors to be taken into consideration for obtaining high makes per ton are as follows:

(*a*) Correct heat zoning and steaming efficiency,
(*b*) Back-pressure conditions at the retort mouthpiece,
(*c*) The particular size of coal carbonized, and last, but by no means less important,
(*d*) The maintenance of low throughputs compatible with the plant being worked as a carbonizing plant and not more or less as a blue water gas plant.

(*a*) *Heat Zoning and Steaming Efficiency.*—To obtain correct and constant heats, the primary item of importance is an ideal producer gas, having a constant pressure and composition with as high a CO figure as possible and a minimum hydrogen figure. This depends on the class of fuel used on the fires and the routine working of the producers. Various experiments have taken place as regards the method and times of pricking up, cleaning, &c. During the last few months we have adopted what, in our opinion, is an ideal system—namely, pricking up half the producer alternately at specified intervals. The right-hand side of the fires is cleaned at 6 a.m. and 6 p.m. and the left-hand section of the fires at 10 a.m. and 10 p.m. By this method less combustible matter is ashed out with the clinker and less cold air is drawn in than there would be if the fires were cleaned more often.

By maintaining a 5/100th pull at the top of the vertical downtake, it is possible to obtain correct heat zoning on any particular section of the retort, and it is fundamentally important to have a high temperature zone at the base of the retort and at the 6 ft. We carried while on the test run, to be referred to later in the Paper, an average of 1,330° C. at the 6 ft. and approximately 1,280° to 1,290° at the base of the retort.

For steaming we have the "Simplon" steaming appliance with dual steam inlets to each retort situated on the minor axes of the retorts. The consumption of steam is quantitatively registered on gauges, either in pounds per sq.in. or in pounds of steam per hour per retort, and from this, when the throughput is known, the percentage steaming is easily ascertained. The size of nozzles for the most effective manner of steaming we have found to be ⅜ in.

(*b*) *Back Pressure Conditions at Retort Mouthpiece.*—The experiences on our plant have proved conclusively that working under limited back pressure conditions has not only materially enhanced our make per ton, but has also reduced our inert content of the gas to a minimum—I say

limited because there is a definite boundary which it is impracticable to pass. Our pressure variations while the test was in progress lay between the limits of 10/100ths and 25/100ths, dependent upon throughput.

(*c*) *Size of Coal Carbonized.*—Carbonizing conditions being equal, we have found that on a comparative thermal basis there is a marked increase in gas yield with washed doubles as compared with washed singles, amounting to no less than 6 to 8 therms. This suggests that larger-sized coals give the best thermal yields.

(*d*) *Maintenance of Low Throughput.*—This to my mind is exceptionally important, particularly from the viewpoint of additional makes per ton obtained by the controlled cracking in the top of the retorts when working under back-pressure conditions.

I will now deal with the results obtained from the carbonization of New Monckton washed gas nuts (size 1¼ in. by ⅝ in.).

The analysis of this fuel as received approximated to:

Volatile matter	36·2%
Ash content	3·9 ,,
Moisture content	2·8 ,,
Fixed carbon	57·1 ,,
Total	100·0 ,,
Calorific value	14,450 B.Th.U. per lb.
	323·6 therms per ton
Sulphur content	1·81%
Coke	Moderate swelling properties

The duration of the test was 11 days. During this period carbonization took place on two beds—that is, 8 retorts—the total coal carbonized being 230 tons.

We commenced with a total throughput on both beds of 25 tons, and the test was terminated on a total throughput of 19½ tons, thus giving an average per retort per diem of 2 tons 12 cwt. 1 qr. The lowest throughput on any individual retort was 2 tons 5 cwt. Back-pressure conditions were between the limits of 7·5/100ths to 25/100ths, and the percentage steaming was from 19·95% to 26·35%, the thermal yield increasing from 96·5 therms to a maximum of practically 105 therms at the end of the test.

During the test, temperatures of the crude gas were taken on one bed from the gas offtake at a height of approximately 18 in. from the top of the mouthpiece, and were found to be as follows:

C Bed.—Back pressure 1/10th. Time before rodding 5 minutes.

C 1 retort	510° F.	C 3 retort	505° F.
C 2 ,,	480° F.	C 4 ,,	530° F.

While under the same conditions five minutes after rodding were:

C 1 retort	370° F.	C 3 retort	350° F.
C 2 ,,	340° F.	C 4 ,,	375° F.

C. Bed.—Under the same conditions as regards steaming, throughput, &c., but with a back-pressure of 2/10ths. Five minutes before rodding:

C 1 retort	430° F.	C 3 retort	405° F.
C 2 ,,	410° F.	C 4 ,,	420° F.

Five minutes after rodding:

C 1 retort	330° F.	C 3 retort	290° F.
C 2 ,,	310° F.	C 4 ,,	315° F.

With these lower temperatures in the offtake pipes, it is conceivable that the work thrown on the condensing system may be alleviated, as the following figures suggest:

Distance of carbonizing plant to inlet condensers, 140 yards.
Size of foul main, 20 in.
Average make per day, 480,000 cu.ft.
Average daily throughput, 20·9 tons.
Daily inlet temperatures for 11 days during test:
68°, 54°, 66°, 64°, 60°, 62°, 61°, 56°, 58°, 54°, 56° F.
Average, 60° F.
Daily inlet temperatures for 10 days prior to test:
66°, 76°, 74°, 72°, 80°, 76°, 80°, 76°, 76°, 78° F.
Average, 75° F.
Total daily throughput, 27 tons. Make per diem, 559,000 cu.ft.
Level gauge conditions, 18·3% steaming.

Therefore, with an average increase of 5·5% steaming there is a loss in the average inlet temperature of 15° F., with a reduction in the daily make of 79,000 cu.ft., or some 3,200 cu.ft. per hour.

A high temperature in the offtake pipe is indicative of excess steaming, but from the analysis of the gas the CO_2 content averaged only 5·1%; consequently steaming was not excessive.

Care was also exercised that each retort was taking its quota of coal, there being no hanging-up of charges in the retorts.

There is an appreciable reduction in temperature of the crude gas while operating back-pressures between the limits of 1/10th and 2/10ths.

The Arca regulator during the test was reliable and more or less instantaneous in action, while operating on very wide limits of differential control, particularly when it is realized that the regulator is situated some 160 yd. distant from the exhauster inlet and at an altitude of 80 ft. above datum. High makes per ton and governing are synonymous, and we are confident that our type of regulator has been of assistance to us in procuring that which we set out to attain—namely, a three-figure thermal yield.

Rodding takes place hourly, and naturally the shift men cannot be expected to rod retorts effectively while working under these back-pressure conditions. Hence, before rodding, the Arca was "set up" so as to obtain a level gauge at the retort mouthpiece until rodding was completed.

We discharge every two hours, and during the test care was exercised to ascertain the total fuel consumption on both beds. Numerous weighings of coke discharged per retort each cycle took place, giving a coke salable figure approximating to 6·3 cwt. per ton of coal carbonized.

The gross fuel consumption at the commencement was 16·2 lb. of coke per 100 lb. of coal carbonized, and at the termination of the test the fuel consumption had increased to a maximum of 20·3 lb. per 100 lb. of coal carbonized, giving an average throughput of 18·9 lb. coke per 100 lb. coal carbonized.

An interesting point is that, under the above carbonizing conditions there was an increase of sulphur compounds present in the gas, amounting to slightly over 4 grains per 100 cu.ft. as compared with the normal manner of carbonization control. Our average sulphur compounds present in town gas varied between 13 and 16 grains per 100 cu.ft. The H_2S content at the inlet of the purifiers averaged throughout the test 420 grains per 100 cu.ft. against 460 grains for our other standard contract coals.

I wish to emphasize that no "revivification *in situ*" was practised while this test was proceeding, otherwise there would definitely have been a sacrifice in therms per ton.

From a survey of the results obtained, it will appear that the upward heating system has a number of commendable features, namely:

(*a*) The ease of coal motion inside the retort, with the more gradual heating effect in the above system. This seems to prevent undue swelling of the charge, particularly in the upper portion of the retort. We have carbonized numerous coals on the plant under conditions both above and below the nominal capacities of the retorts and we have never experienced any difficulty as regards coal travel.

(*b*) The various heat zones obtainable with upward heating are claimed to reduce scurf formation, and we can substantiate that claim from our experience. Our normal scurfing cycle is 7 to 8 weeks, and even when working with low throughputs and excess back-pressure, the maximum thickness of scurf at the top of the retort has not exceeded ¾ in. to 1 in.

(*c*) Upward heating does improve the make per ton of coal carbonized, and from our test the moderately low top temperatures, together with back-pressure conditions, contribute to a higher methane content. Also the high temperature zone towards the base of the retort is conducive to a good steaming reaction.

Below is appended an analysis of the gas taken towards the termination of the test:

CO_2	5·1%	
O_2	0·2 ,,	
CO	18·9 ,,	
C_nH_m	1·1 ,,	
H_2	50·6 ,,	
CH_4	19·6 ,,	
N_2	4·5 ,,	
Total	100·0 ,,	
Inerts	10·8%	
Specific gravity	0·462	
Calculated C.V.	450·3	B.Th.U. (gross)

I am convinced that we have not reached finality as regards the maximum thermal yield which can be obtained per ton of coal carbonized, and I am confident that by the adoption of Drakes latest type of 6 ton per diem retort giving a greater cross-sectional area both at the top and at the base of the retort—with an increased major axis dimension and a reduced minor axis dimension—and resorting to the conditions described in this Paper, infinitely better results will accrue as regards thermal yield.

The PRESIDENT, Mr. A. K. Collinge (Preston), congratulated the Author on his Paper; and Mr. H. B. Knowles (Padiham) proposed a vote of thanks to Mr. Derbyshire, which was seconded by Mr. J. A. Speers (Preston).

Gas Undertakings' Results

Blyth.

The report of the Directors of the Blyth Gas Company for the year ended Dec. 31, 1935, states that the revenue amounts to £43,945 and the expenditure to £34,283, leaving a profit on the year's working of £9,662. The Directors recommend that a dividend of 4% less income-tax on the ordinary stock be paid, making with the interim dividend paid in August last 8% for the year 1935, and that the balance of £12,645 be carried forward to the next account. The Directors greatly regret to record the death of Mr. Robert Bell who had been Chairman of the Company since 1930, and a Director since 1907, and desire to pay tribute to the very valuable and devoted services rendered by Mr. Bell during his long connection with the Company. Mr. Gregory Dobson has been appointed Chairman of the Company, and Mr. Charles Rutherford, Deputy-Chairman. The vacancy on the Board has been filled by the appointment of Mr. George J. Robinson. The make of gas for the year has established a record in the history of the Company, 221,723,000 cu.ft. (1,003,584 therms) having been produced.

Camborne (South-Western).

The report of the Directors of the Camborne Gas Company, Ltd., for the half-year ended Dec. 31, 1935, states that with a view to bringing the Company into line with the other subsidiary companies of the South-Western Gas and Water Corporation, Ltd., it was decided at the last annual general meeting that until further notice the annual general meeting of the Company shall be held in the month of February or March. In order to carry this into effect the accounts for the half-year ended Dec. 31, 1935, have been prepared. The Directors report that the demand for gas has been fully maintained. Considerable leakage of gas, however, has been experienced during the past six months, due to road repairs and other causes, but this is now being dealt with and overcome. The balance standing to the credit of profit and loss account amounts to £3,727, which the Directors recommend should be appropriated as follows: Dividend at the rate of 2½% for the half-year (less income-tax), £426, and carried to next account, £3,301.

Canterbury.

The sales of gas by the Canterbury Gas and Water Company for the year shows an increase of 1,836,700 cu.ft. Extensive repairs to the large gasholder at Wincheap have been carried out, the whole of the cost of which has been charged to revenue account. After payment of interest on the loan capital, there is standing to the credit of the dividend account the sum of £8,714. An interim dividend of 4% having been paid in August last, the Directors now recommend a further dividend of 6%, less income-tax, making the uniform dividend on the total capital 10% for the year.

Chester.

The Directors of the Chester United Gas Company present accounts for the year 1935 showing a balance of net revenue account, after payment of interest and dividend on debenture and preference stocks and interim dividend on ordinary stock, of £13,687. They recommend the payment of a dividend on the ordinary stock of 3¼%, making 5¾% for the year. After appropriation of the amount required for this dividend (£5,426) the balance to carry forward will be £8,260. The installation of the vertical retort plant, referred to in the last report, was completed and brought into operation at the beginning of November last, and it is giving every satisfaction. To meet additional expenditure an issue was made in September last of £40,000 4% preference stock. The whole issue was subscribed, the tenders accepted resulting in the receipt, including premiums, of £40,463. Capital account has been debited with the value of the increased capacity of the plant. Reserve and special purposes funds have been drawn upon towards the costs of renewals and replacements, the balance being charged to revenue account. The severe weather during the latter part of the year resulted in largely increased sales of gas, fresh records being established.

Colchester.

The sales of gas by the Colchester Gas Company for the year showed an increase of 13 million cu.ft., equal to 4·3%. Very heavy expenditure has been incurred in modernizing cooking stoves let on hire to consumers, no less than 1,744 stoves having been changed and brought up-to-date by means of the modern plant installed a few years ago. Foreseeing the prospect of an increase in the cost of coal the Directors made forward contracts in March last, which secured supplies up to November, 1937. The National Gas Council have now recommended, subject to certain conditions, that all their members should agree voluntarily to increase the price paid for coal under contract by 1s. per ton, in order to enable miners' wages to be increased, and the Directors have consented. It is not anticipated that this extra charge will necessitate any increase in the price of gas. The gross profit on the revenue account amounts to £15,864, after allocating £2,000 to the special purposes fund, £600 to the renewal fund, and reserving £500 for bad debts. Interim dividends were paid in September at the following rates: £5% on the "A" shares, £3 10s.% on the "B" shares, and £3% on the 6% preference stock, and the Directors recommend the payment of final dividends at the same rates, and that such dividends be less income-tax. During the year additional capital was raised by the sale of £2,520 preference and £4,000 debenture stock.

Cork.

The Directors of the Cork Gas Consumers' Company report substantial increases in the sales of gas and residuals. The balance of profit and loss is £4,532 with which it is proposed to pay the usual dividend at the rate of 8% per annum. The Engineer, Mr. J. McNicholl, reports that three retort settings in No. 3 bench and the hot coke conveyor of No. 1 bench are due for thorough overhaul and arrangements are being made for this work to be carried out during the summer.

Derby.

The Directors of the Derby Gas Light and Coke Company submit accounts for the year ended Dec. 31, 1935, which show that an interim dividend of 3½% was paid on the consolidated ordinary stock for the June half-year, and the Directors now recommend a final dividend of 5%, making 8½% (less income-tax) for the year. The Company's business continues to extend, consumers having increased in number during the year in the Derby area by 1,158. In addition, the amalgamation with the Langley Mill Company's Undertaking has added 8,520, bringing the total to 63,087 consumers. The sale of gas shows an increase of about 50 million cu.ft. in the Derby area, being 2·65% for the year. The improved industrial conditions were reflected by an increase in the demand for gas, especially during the last six months. The Langley Mill Company's figures for the last half-year bring the increase to 6·6%. There has been an increase in the number of gas appliances in use for domestic and industrial purposes of 4,855 for the year. In addition, the Langley Mill Company have some 12,500 various gas appliances in use in their area of supply. An issue at par of £100,000 of 4% redeemable debenture stock was largely oversubscribed. It is eight years since a capital issue was made, and during this period the undertaking has considerably extended in various directions. The Langley Mill and Heanor Gas Light and Coke Company's Undertaking was transferred to this Company as from July 1 last, in accordance with the Board of Trade Special Order, 1935. The Langley Mill Company continued in control to the end of the year with very satisfactory results. The half-year's working indicates that the amalgamation will be to the advantage of both Companies and consumers.

Gloucester (Severn Valley).

The report of the Directors of the Gloucester Gas Light Company for the year ended Dec. 31, 1935, states that the Directors recommend to the proprietors a dividend of 5% per annum upon the consolidated ordinary stock of the Company (less income-tax) for the year ended Dec. 31, of which an interim dividend for the half-year ended June 30 last has already been paid. During the year application has been made to the Board of Trade for a Special Order, and the Gloucester Gas Order, 1935, was granted in December last and came into operation on Jan. 1, 1936.

Harrogate (United Kingdom).

The report of the Directors of the Harrogate Gas Company for the year ended Dec. 31, 1935, states that the profit on revenue account is £31,921. The net revenue account after payment of interest on debenture and dividend on the preference stocks, co-partnership bonus for the year 1934, and an interim dividend on the new consolidated stock, shows an available balance of £34,085. The Directors recommend the payment of: 3% on the new consolidated stock (making the maximum 6% for the year), £8,114, and co-partnership bonus for 1935 £1,807, leaving balance forward to net revenue account, £24,163. On Jan. 10, 1936, the United Kingdom Gas Corporation, Ltd., obtained by purchase of new consolidated stock, a controlling interest in the Company. On completion of this purchase, Messrs. Francis Barber, J. W. Knowles, and C. A. Barber tendered their resignations from the Board. Mr. Michael Hubert Tetley, M.I.Mech.E., Col. Wm. Moncrieff Carr, O.B.E., T.D., M.Inst.Gas E., and Mr. Charles Bateman, M.Inst.Gas E., were appointed Directors to fill the vacancies caused by these retirements.

Hartlepool.

The report of the Directors of the Hartlepool Gas and Water Company for the year ended Dec. 31, 1935, states that the profit for the year, after including grants received from H.M. Treasury under Development (Loan Guarantees and Grants) Act, 1929, and paying interest on debentures, &c., is £27,747, which, together with the sum of £23,665 brought forward from last year, makes a total of £51,412. After paying an interim dividend of 2½% less income-tax, there remains an available balance of £37,229, out of which the Directors propose to declare a final

dividend of 2¼% less income-tax (making 5% for the year), absorbing £14,183, and leaving a balance of £23,047 to carry forward to the next account.

Horley.

After payment of dividends in respect of the half-year ended June 30, 1935, at the standard rates, all less income-tax, and providing for the fixed charges for interest, &c., the profit and loss account of the Horley District Gas Company shows an available balance of £5,097. The Directors recommend payment of dividends in respect of the half-year ended Dec. 31, 1935, at the rate of 5% per annum on the preference stock, 10% per annum on the "A" capital stock, and 7% per annum on the additional "B" capital stock (all less income-tax), which will absorb the sum of £2,187, leaving a balance of £2,910 to be carried forward to the next account.

Keswick.

The report of the Directors of the Keswick Gas Company for the year ended Dec. 31, 1935, states that after allowing for depreciation of cookers and meters, the revenue account shows a balance to credit of £1,437 on the year's working. Deducting from this amount £44 for interest on loans, £637 for income-tax, and adding £189 interest on investments, there remains a sum of £945. The Directors propose a dividend at the rate of 10% per annum upon the original capital of the Company, and at the rate of 7% per annum on the additional capital of the Company (both less income-tax). This will absorb £825, leaving £120 to be added to profit and loss (net revenue) account. There has again been an increase in the output of gas. The price of gas was further reduced as from Jan. 1, 1935. During the year two beds of retorts, including furnaces and main arches, were rebuilt, and a new gas engine purchased. During the year, Mr. J. H. Wilson, who was elected a Director at the last annual meeting, retired through ill-health. The Directors regret to report that Mr. Wilson's death occurred soon afterwards. Mr. J. A. Oglethorpe was elected in his place.

Leatherhead.

During the year the sale of gas by the Leatherhead Gas and Lighting Company increased by 3·79%. On March 13, 1935, the Company entered into a provisional agreement for the acquisition of the Undertaking by the Wandsworth and District Gas Company, and an application was made to the Board of Trade for a Special Order for the transfer of the Undertaking to the Wandsworth Company. An enquiry was held by the Board of Trade into the application in June last, and on Dec. 4, 1935, a Draft Order was laid on the table of both Houses of Parliament for approval. Two petitions praying for leave to be heard against certain provisions of the Order were deposited, and these Petitions will probably be heard by the Special Orders Committee of the House of Lords very shortly. The accounts show that, after deducting the dividends paid in September, and providing for all fixed charges and interest, there remains for division a balance of £5,761. The Directors recommend the payment of dividends for the second half-year as follows: On the preference stock 3%, making a total of 6% for the year; on the redeemable preference stock 3¼%, making a total of 6½% for the year; and on the ordinary shares 4½%, making with the interim dividend of 2½% a total of 7% for the year. These dividends (less tax) absorb £4,511, and leave £1,250 to be carried forward to the next account.

Leighton Buzzard.

The Directors of the Leighton Buzzard Gas Company present a statement of accounts for the year ended Dec. 31, 1935, which states that the revenue account shows a balance of £4,274, and the balance standing to the credit of the profit and loss account is £3,495. The Directors recommend that a dividend at the rate of 6% per annum be paid on the consolidated ordinary stock, amounting to £3,111 from which income-tax amounting to £700 has to be deducted.

Maidstone (S.E. Gas Corporation).

The accounts of the Maidstone Gas Company for the year show that after paying in respect of the half-year a dividend at the rate of 8% per annum on the 5% capital stock, and after providing for all fixed charges (including £2,000 for depreciation of meters and a contribution to the reserve fund of £2,504) there is a total available balance of £13,037, out of which the Directors recommend the payment of the following dividend in respect of the second half-year—viz.: On the 5% capital stock at the rate of 10% per annum, which will absorb the sum of £8,286, leaving £4,751 to be carried forward to the credit of the current year. The sum of £2,000 has been written off the commuted pensions suspense account. The sales of gas show an increase of 1·54% compared with the year 1934.

North Middlesex.

The sale of gas for the year by the North Middlesex Gas Company shows an increase of 2·1% compared with that for the preceding year. New building development continues to create a demand for gas as a labour-saving fuel. The profit for the year (including interest received) after charging interest on debenture stock and temporary loans, income-tax, &c., and transferring the sum of £2,000 to the contributory pensions fund, amounts to £23,446, which, with £7,722 brought forward from the previous year, makes the disposable balance £31,168. Interim dividends on account of the year ended Dec. 31, 1935, declared by the Directors, were paid in September last at the following rates—viz.: On the 5% preference stock at the rate of £5% per annum, on the 6% preference stock at the rate of £6% per annum, and on the standard consolidated stock at the rate of £7 10s.% per annum (less income-tax), and the Directors now recommend the declaration of final dividends for the year ended Dec. 31, 1935, at the same rates. These appropriations (including the interim dividends) amount to £23,425, leaving £7,743 to be carried forward to the credit of the profit and loss account for the current year. During the year £15,000 4% debenture stock was issued, realizing £15,375 the proceeds being credited to capital account.

Oxford.

The report of the Directors of the Oxford and District Gas Company for the year ended Dec. 31, 1935, states that the Directors recommend the payment of dividends for the half-year ended Dec. 31, 1935, at the full nominal rates per annum on the 5% and 4½% preference stocks and the 6% redeemable preference stock, respectively; and at the rate of 10% per annum on the consolidated ordinary stock; all less income-tax. These payments, with the interim dividends on the 5% preference stock, 4½% preference stock (1st issue), 6% redeemable preference stock and consolidated ordinary stock, paid for the half-year ended June 30, 1935, make 5%, 4½%, 6%, and 10%, respectively, for the whole year; and in the case of the 2nd issue of the 4½% preference stock, with the interim dividend, 4½% from April 1, 1935. The Directors have again to report a satisfactory increase in the consumption of gas during the year; also that the demand for all types of gas appliances continues good. During the year a commencement has been made in supplying gas in bulk to the South Midland Gas Corporation, Ltd. As anticipated, the new scale of charges introduced during the year 1934 has led to an increased use of gas for all purposes. In accordance with the provisions of section 23 (1) (*c*) of the Oxford Gas Order, 1930, the price of gas in the Abingdon area has been reduced to the Oxfordshire price as from Jan. 1, 1936, thereby effecting a reduction of 1½d. per therm. A like reduction in price has been made in the case of the added area under the Oxford and District Gas Order of 1932 Section 30 (*b*), which includes the parishes of Didcot and Harwell.

Portsmouth and Gosport.

The recent merger of the Portsmouth Gas Company with the Gosport Gas Company has brought about unity of control over a large area of country (nearly 200 square miles), the capital of the combined Company being now £1,373,740. The market value of the shares to-day is roughly about £2,000,000. The accounts submitted to Dec. 31 deals only with the former Portsmouth Gas Company before the merger. The sum of £6,712 has been spent on land and buildings, and it is proposed to provide thoroughly up-to-date showrooms at Cosham and Emsworth. On new meters there was an amount of £15,000, many having to be replaced because the old ones were too small, and a large amount had been spent on reconditioning and installing new meters. Repairs and maintenance of works had cost £53,000 as against £57,000 the previous year. Hired appliances accounted for £66,000 against £54,000 last year. On the credit side the revenue from private consumers of gas had increased by about £6,330, and that the increase in the amount of gas sold amounted to 30 million cu.ft. The balance available for dividend on the profit and loss account was £68,309, out of which the dividends would absorb £26,843, and the carry forward was £41,465. In 1931 the Company sold appliances to the value of £25,000; last year the figure was £78,000.

South Shields.

The annual report of the South Shields Gas Company shows a profit of £20,122 against £20,396 for 1934, a decrease of £273. With bank interest £68 and £14,182 brought forward £34,372 is available. It is proposed to pay a year's dividend on the consolidated stock at 8½% and on the ordinary stock at 5¾%, leaving £14,216 to go forward. The quantity of gas sold was 514,901,680 cu.ft., an increase of 0·17%.

Tunbridge Wells (S.E. Gas Corporation).

The Directors' report on the workings of the Tunbridge Wells Gas Company for the year ended Dec. 31, 1935, states that after paying in respect of the June half-year dividends at the rate of £7 4s.% per annum on the sliding scale stock, £5% per annum on the maximum stock, and after paying all fixed charges, there is a total available balance of £37,436, out of which the Directors recommend the payment of the following dividends in respect of the December half-year—viz., on the sliding scale stock at the rate of £7 4s.% per annum, and on the maximum stock at the rate of £5% per annum. This will absorb the sum of £8,844, leaving £28,592 to be carried forward to the credit of the current year. The work of extending the Company's mains to Withyham and Hartfield was completed during the year. The number of consumers has increased by 488 during the year, and 2,102 additional appliances have been sold or let out on hire. The Directors regret that owing to ill-health Mr. H. A. Beeching has retired from the Board, and they desire to place on record their appreciation of the valued services he rendered the Company over the long period of 37 years, during 11 of which he was Chairman.

Wellington (Salop).

The report of the Directors of the Wellington (Salop) Gas Company for the year ended Dec. 31, 1935, states that the

Undertaking has made a profit of £7,259. The Directors recommend the payment of a dividend of 3% on the redeemable preference stock for the half-year ended Dec. 31, 1935, making with the interim dividend already paid, 6% for the year, less tax. On the ordinary stock, the Directors recommend a dividend of 3½% for the same period, making with the interim dividend already paid, 7% for the year, less tax. The year's trading has been satisfactory; gas sales showing an increase of 5½% over 1934 when sales showed an increase of 5·3% over 1933. The Directors record with deep regret the resignation through ill-health of Mr. Charles Whitford Leake. For the past 18 years as Chairman and in all 45 years Mr. Leake has been a member of the Board. Mr. Victor G. Leake has been elected to the Board to fill the vacancy.

Winchester.

The report of the Directors of the Winchester Water and Gas Company for the year ended Dec. 31, 1935, states that the balance of net revenue available for dividend is £19,496. Interim dividends of £2, £2 15s., and £2 10s.% on the preference stocks and £2 10s.% on the consolidated ordinary stock, less income-tax, were paid on Sept. 2 last, and the Directors recommend the payment on March 2 next of final dividends of £2, £2 15s., and £2 10s.% on the preference stocks and £3% on the consolidated ordinary stock, all less income-tax. The additional ½% on the consolidated ordinary stock represents the undivided portion of the authorized dividend for the half-year ended Dec. 31, 1907. The sale of gas has increased by over 4 million cu.ft. or 2% more than during 1934. Following the circular letter sent to stockholders on Nov. 15 last, negotiations are still proceeding with regard to the proposed transfer of the Water Undertaking to the Winchester Corporation and the Gas Undertaking to the Southampton Gaslight and Coke Company. The Agreements have not been finally settled, and the Extraordinary General Meeting will be called when the Directors are satisfied that the terms can be submitted to the stockholders for their approval.

Wolverhampton.

The report of the Directors of the Wolverhampton Gas Company for the year ended Dec. 31, 1935, states that the net profit for the year, after payment of interest on the debenture stocks and contribution to the pensions fund, is £20,656. An interim half-year's dividend was paid on Aug. 28, 1935, at the following rates: £3% on the 6% preference stock; £2½% on the 5% preference stock; and 3½% on the consolidated ordinary stock. The Directors recommend final dividends at the same rates for the half-year ended Dec. 31, 1935, all less income-tax. They also recommend that the sum of £2,000 be placed to the reserve fund, the balance of £240 being carried forward. The Directors report a substantial increase in the sale of gas (particularly in the industrial field), the total increase over 1934 being 3·13%. The number of consumers continues to increase, and there have been record sales of gas cookers and washing coppers during the past year. The issue of £30,000 additional consolidated ordinary stock in July last was entirely successful, being largely oversubscribed.

The Bournemouth Gas and Water Company

The One Hundred and Fifteenth Ordinary General Meeting of the Bournemouth Gas and Water Company was held at the Offices of the Company, 48, Copthall Avenue, London Wall, E.C. 2, on Friday, Feb. 28—Mr. WILLIAM CASH, J.P., F.C.A. (Chairman of Directors), presiding.

The SECRETARY (Mr. William Cash, Junr.) read the notice convening the meeting, together with the minutes of the previous ordinary general meeting, which were duly confirmed and signed.

THE CHAIRMAN'S ADDRESS.

The CHAIRMAN said that he had to propose: "That the Directors' Report and Accounts for the year ended Dec. 31, 1935, as presented to this meeting, be received and adopted." But before he proceeded he would like to refer to the absence of Sir John Withers. The House had sat until a very late hour the previous night and he had had to go back there that morning. He had therefore asked the Chairman to apologize for his absence. Sir John was a very valuable Director, said Mr. Cash, and he was sorry he was not with them on that occasion.

Turning now to the report and accounts, continued the Chairman, they would observe that the capital account was divided into Gas and Water. Expenditure in the gas column included final payments in regard to the new showrooms at Boscombe and the new purification plant at the Pitwines Works; also the enlargement of the benzole plant and the additional tar plant. Furthermore, new showrooms were in course of erection at Wimborne. They would be interested to know that they had laid thirty-four miles of new gas mains during the year, which included a substantial sum in respect of mains laid in order to connect their works with the undertakings taken over. They had laid nearly seven miles of water mains.

There was a deduction in respect of replacement and removal of plant and works, which included the works now out of use at Lymington, Ringwood, and Wimborne, and that amount of £20,058 had been written off the special purposes fund. He thought it would be agreed that they had done the right thing in writing off these works in this way, rather than leaving them in the capital account. In place of these works they had laid trunk mains—which were included in the capital account to the amount of £24,000.

They would be glad to know that in respect of these three undertakings taken over they had secured 494 new consumers, while they had sold in the additional areas nearly £5,000 worth of gas apparatus. The sales of apparatus throughout the whole Company were wonderful; last year they passed the £100,000 mark in showroom sales—an increase of £29,631, or 41·75%, over the figure of the preceding year. To give some indication of the volume of the work undertaken by the sales staff the number of major appliances fixed on hire, hire-purchase, or sold outright was 17,467. Some of these, of course, replaced apparatus previously fixed on hire and now sold on hire-purchase. It was satisfactory to notice once more that of the 2,294 houses completed in the area during the year only twenty-one were devoid of a gas supply. Of the 6,336 houses completed during the past five years only 38 were all-electric.

They had spent a great deal of time and money in an endeavour to satisfy their consumers, and in this connection they had made 8,448 house-to-house inspections last year, and 16,338 major appliances had been adjusted. These same members of the staff had sold £16,000 worth of apparatus.

New Consumers.

The total number of new gas consumers, including those brought in by the added areas of Lymington, Ringwood, and Wimborne, was 7,296, while the new water consumers numbered 1,297. They were now engaged in spending a certain amount of money towards increasing the water pressure in Bournemouth.

Turning to the other side of the capital account, it would be seen that £40,357 of 7% maximum dividend stock had been issued to the proprietors of the three Companies taken over, together with £4,800 of preference stock, while a certain amount had been paid out in fractional payments. The issue was made at 150, and the relative premiums appeared lower down on the account. They would find in the balance-sheet an item of suspense account compensations. They had to pay a certain amount in compensation to officers displaced, and they had written off a proportion of these compensations, while the whole of the Parliamentary expenses had been carried forward to be dealt with in the next two years.

The Revenue Account.

Turning to the revenue account, it would be seen that the gas profit was up by £8,716, which was satisfactory in view of the fact that during the preceding year the sales had only shown a very small increase. For the first time their sales included those of the three undertakings they had taken over, where gas was sold at a slightly higher price. This had raised the receipts by £6,000.

Residuals were also up, partly for the same reason. By reason of the fact that they had made more gas, the purchase of coal and oil was up by the substantial sum of £16,000.

A satisfactory feature of the whole gas account was that their sales of gas were up by 159 million cu.ft., of which Lymington, Ringwood, and Wimborne—the last-named for the final six months of the year only—had contributed 77½ millions. Excluding the three added areas, the sales were up by 3·2%, which was very satisfactory. Expressed as a percentage, the figure might seem small, but it represented an increase of 81 millions in their own area.

In the revenue account they had placed £11,928 to renewal fund (gas) and £3,976 to renewal fund (water), while £15,000 had been placed to special purposes fund—the same as a year ago. These funds were getting rather substantial, and they might have to consider whether it was necessary to charge

quite so much in the future. The renewal fund was answerable to both undertakings.

It would be seen that they had made no appropriation to reserve fund this year, as compared with £5,000 last year. The amount in this fund was nearly £200,000, and its income from interest alone was £7,185. So in view of the fact that they were writing off compensations and Parliamentary expenses, they thought there was no necessity to pay into the reserve fund this year.

The increase in the amount required for dividend was mainly due to the fact that they had issued preference and other stock to the proprietors of the three undertakings taken over—which called for £4,041 more than a year ago. Their profits were £7,000 more than a year ago, and yet their carry forward would be reduced by £4,403.

There was one other item to which he would like to refer on the left-hand side of the balance-sheet; this was reserve fund investments—suspense account, the profit on which amounted to £8,951. They had realized some of these investments and put the money back again into other investments, making thereby a profit which they were not putting to the reserve fund but leaving as a sort of investment reserve account against the possibility of a fall in the value of some of their investments, the total of which to-day showed the very substantial surplus over their book value of £22,817 in respect of reserve fund and £10,582 in respect of special purposes fund. Their pension fund investments continued to show a surplus.

The Chairman went on to refer to the findings of the Parliamentary Committee on water supply, before which body he had had the honour of giving evidence. They were pleased with the findings of this Committee, and they hoped that legislation on the lines desired would ultimately follow.

Electrical Competition.

In regard to electrical competition, those who lived in their area would have noticed in the local Press that the new baths which the Corporation were erecting in Bournemouth were to be heated by electricity. Furthermore, the main road lighting was to be transferred to electricity, and in that connection he had before him a newspaper cutting in which the Mayor of Bournemouth was reported to have said that "The time had come to take to electricity for their main roads." He would not like the proprietors to think the Company had been asleep in regard to this matter. Their General Manager had been keen, and they had done their best to obtain both these contracts. They had submitted figures which would have shown a saving if gas had been adopted instead of electricity for both these items. Their high-pressure lighting had been offered on terms which were better than those offered by the other commodity, while the results would have been equally effective. While the Mayor had been speaking on the subject he had also hoped that electricity would be cheaper. Another speaker at the same gathering had said: "Before the grid can pay, the present consumption of electricity in these Islands must go by leaps and bounds." Mr. Cash ventured to think that in this respect he was quite right.

All these matters combined towards competition on an expensive basis. He had been interested to read a Paper contributed to a well-known electrical journal by an electrical engineer and to find that this gentleman had put forward a plea for co-operation between electricity and gas in the national interests. The Paper had as its subject the elimination of waste and of true economy—that was, the use of any material with a minimum of waste.

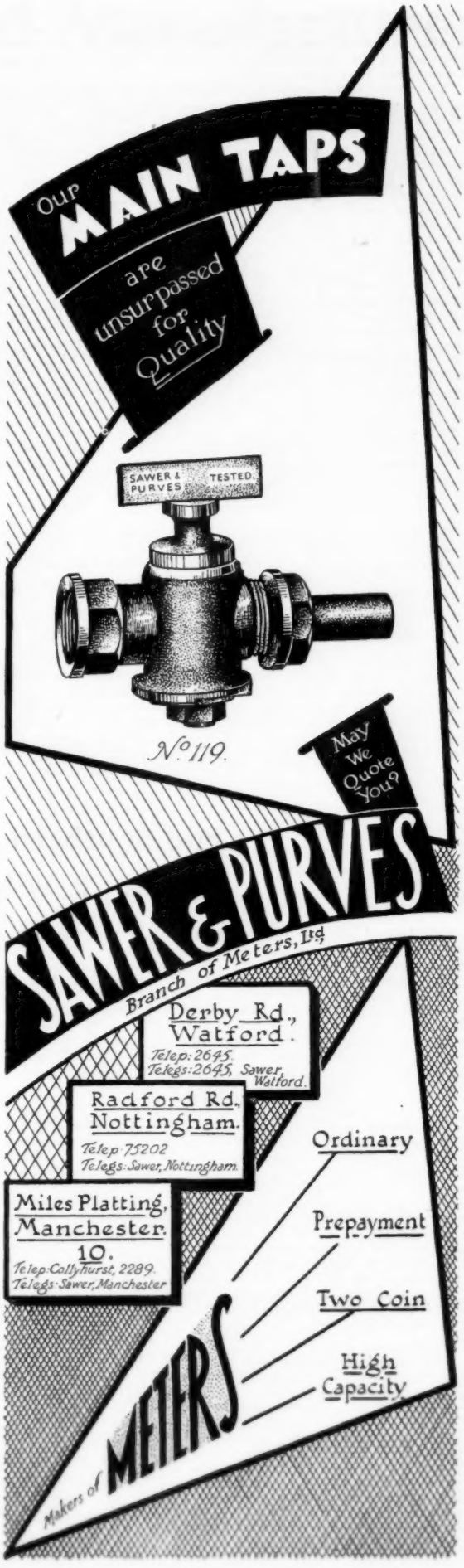
This would not be a proper occasion, said the Chairman, nor was time available, to deal with this subject in detail; but he noticed the phrase "insane competition," and also that one part of the argument was devoted particularly to heat production and showed that, including capital cost and having regard to maximum loads, there was much to be said for the use of gas in this direction rather than by a method which involved heavy expenditure out of proportion to service rendered.

The Coal Position.

Everybody there on that occasion would know that the public utility undertakings of the country had voluntarily agreed to pay an additional 1s. per ton for their coal. In their case they were doubly hit because they utilized coal for both their gas and water undertakings. It was a little hard that having entered into contracts on a satisfactory basis they should be asked to make this increase; but as had been stated over and over again, public utility undertakings felt that it was a reasonable thing to do in order to get over the present difficulties—though he was afraid they were not at an end.

As the public wanted these additional wages to be paid and as this contribution was to be utilized solely to make these extra payments to the miners, the public would not be surprised if the price of gas had to be raised as a result. Not only was there the direct charge in respect of coal itself, but the tendency was bound to put up the cost of other materials as well.

The Directors had, with some reluctance, decided to increase the price of gas by 0·2d. per therm (or 1/10th of a penny); but they did not propose to make this apply to their outside areas where there was already a differential price in force. The increase was equivalent to 2½%, or, assuming an annual gas bill of £8 4s. (a consumption of 240 therms, or about the average for prepayment consumers) the increase would amount to 4s., or 1d. per week, which was not going to cause any substantial hardship. This increase would apply for only nine months of the year, and he thought consumers would appreciate the neces-



sity of what they were doing. It was not, of course, a thing they desired to do; their object was to sell gas as cheaply as possible, and the last thing they wanted to do was to put up the price; but in the circumstances he was sure they would approve of what they were proposing to do.

There were many problems involved in the question of the production and sale of coal. Some of these were of a semi-political character, but those industries, like gas and other public utilities who used coal, were very anxious to see that any re-organization of the coal industry which was accomplished would not tend to put up the price of coal or create a monopoly on lines which might involve discrimination against public utilities.

He had seen, and no doubt they had, in the House of Commons the previous Tuesday night the Secretary of Mines stated that they were proposing to introduce a Bill at an early date to amend Part 2 of the Act so as to give the Coal Mines Re-Organization Committee effective powers to bring about colliery amalgamations. This statement did not seem to have pleased the coal and colliery owners, because they were intent, for the moment, on the re-organization of selling. But however that might be, he was personally more concerned to know whether Part 1 was not also ripe for revision, particularly on the vexed question of Quotas, which to-day had the effect of hampering the more efficient mines by leaving a proportion of the production of coal in the hands of the inefficient undertakings. The present system tended, as it must do, to keep up the price of the coal raised by the industry as a whole.

The CHAIRMAN then formally moved the resolution for the adoption of the Report and Accounts, which was seconded by Sir CHARLES L. MORGAN, C.B.E., M.Inst.C.E. (the Deputy-Chairman), and carried unanimously.

Dividends.

The CHAIRMAN thereafter moved the payment of dividends for the half-year ended Dec. 31, 1935, at the rates of 6% on the preference stock, 7% on the maximum dividend stock, and 9½% on the standard 5% (sliding-scale) stock.

This resolution was seconded by Lieut.-Col. H. W. WOODALL, C.I.E., M.Inst.C.E., and unanimously agreed to.

Re-Election of Directors and Auditor.

The CHAIRMAN, in moving the re-election of Sir Charles L. Morgan and Sir John J. Withers, being the two Directors retiring by rotation, said that each of them, in their individual capacities, were of the greatest possible value to the Company, and they were to be congratulated in having two gentlemen of their calibre on the Board. Sir Charles Morgan was a Past-President of the Institution of Civil Engineers, and his knowledge as an engineer was of the greatest help to them, apart from his business ability. Sir John Withers was a Member of Parliament and a Solicitor, and his legal knowledge was of considerable benefit to them.

Sir GEORGE JESSEL, Bart., seconded the resolution, which was carried unanimously; and Sir CHARLES MORGAN briefly acknowledged this renewal of their confidence.

Thereafter, Mr. W. B. Paton, F.C.A., the retiring Auditor, was duly re-appointed.

Vote of Thanks.

The CHAIRMAN said that before they parted he wanted to ask them to be good enough to join with the Board in passing a hearty vote of thanks to the General Manager, Secretary, staff, and workpeople both in London and Bournemouth for their work during the past year. He had told them before how well served they were in this Company right from the top to the bottom, and he attributed this to the spirit of co-partnership which was in operation at Bournemouth. The whole staff worked hard in the interests of the Company, and the Board could pay full testimony to this. He would not like this meeting—which only took place once a year—to break up without putting on record their appreciation. The Board must be dependent upon those who worked for them. It was a tribute to them individually and to the General Manager that this spirit was fostered from top to bottom. He would like to propose this vote of thanks, and was sure that one of the shareholders present would wish to second it.

The vote was seconded by a shareholder and unanimously carried.

Mr. PHILIP G. G. MOON, M.Inst.C.E. (the Engineer and General Manager), in acknowledging the vote of thanks, said he was quite sure that every member of the staff at Bournemouth would greatly appreciate this expression of appreciation. They had had the busiest year in the history of the Company; they had sold more gas, pumped more water, and fixed more apparatus, and the whole of the work involved had been done very willingly, efficiently, and enthusiastically by every member of the staff. Every man regarded the Company partly as his own; he felt he was working for his own interests—which was the effect of the spirit of co-partnership. This was a very real thing with all their workpeople. He was sure that every member of the staff would wish him to thank the meeting for their very hearty vote of thanks, which he did on their behalf and his own with the greatest sincerity.

The meeting terminated with a hearty vote of thanks to the Chairman and Directors for their care and attention to the affairs of the Company during the year upon the proposition of Mr. PATON, which Mr. CASH briefly acknowledged.

Mid-Southern Utility Company

Mr. R. W. Edwards's Address

The Annual Meeting of the proprietors of the Mid-Southern Utility Company was held at Farnborough on Feb. 27—Mr. R. W. EDWARDS presiding.

The SECRETARY read the notice convening the meeting, and after the minutes of the previous annual general meeting and an extraordinary meeting held on Feb. 14, 1935, had been confirmed,

The CHAIRMAN said: The report and accounts have now been in your possession for some days, and, with your permission, I propose to follow the usual course and take them as read.

Electricity.

This department continues satisfactorily to extend its sales, and there is every indication that the Company's policy of low tariffs for purposes other than lighting will eventually lead to a considerable increase in the use of various apparatus which are offered on attractive terms. The net increase in sales, compered with 1934, represents nearly 28%. The consumptions on our various works and all subsidiary undertakings are excluded.

During the past year the apparatus fixed increased the load by 7,079 kW, compared with 6,466 kW for the previous year. The prospects appear good, and already the number of orders so far received this year for cookers exceeds the total number fixed during the whole of 1935. A greater demand is also being shown for all other types of apparatus.

Gas.

The sale of gas for the past year shows an increase of 0·62%. This result may be accepted with equanimity, if not with satisfaction, for two main reasons. The climatic conditions prevailing in 1935 were, in the average, of a very similar order to 1934, and certainly did not encourage any great increase in the use of gas. The second reason is that the public is effecting great saving by the use of the newer and more economical types of gas stoves, both for cooking and heating. The tremendous number of these modern appliances, which are now displacing obsolete patterns, and the consequent effect upon consumption, must be taken into account in reviewing the results of any progressive gas undertaking in these days.

The revenues from coke and tar show an improvement, but ammonia products continue somewhat unprofitable. The water department has been satisfactory, and the various plants, reservoirs, and underground works have been well maintained.

Capital.

Over the past year, deducting depreciation of £33,347 19s. 6d., the capital expended was £41,277 8s. 8d., bringing the total to £1,449,861 18s. 11d. The rapid expansion of the Company's activities necessitates the raising of further capital, and the Directors have authorized an immediate issue of £100,000 4% consolidated preference stock. Particulars relating to this issue will reach you in a day or two with your dividends.

General.

During the year we added, in all departments, including subsidiary undertakings, 6,028 consumers, making a net increase of 37,400 in 12 years. You will doubtless have seen in the Press that, by common consent of their respective national organizations, the various public utility services have agreed to a voluntary surcharge of 1s. per ton on existing coal contracts.

The whole of the increase is to be applied to improving the conditions of pay among the mine workers, and though the gesture has undoubtedly had its effect in helping to stave off, for the time being, a stoppage of work, the cost to the supply undertakings will be very heavy. There are no appropriate reserves to draw upon for expenses of this kind, and when the effects can be reviewed a little more closely than is possible at present it may be found necessary to increase slightly the charges for our commodities.

He concluded by moving the adoption of the report and accounts.

The DEPUTY-CHAIRMAN (Mr. T. A. Braddock) seconded the motion, which was unanimously passed, and, after Mr. Braddock had been re-elected a Director and Mr. A. E. Cutforth, F.C.A., an Auditor of the Company, a hearty vote of thanks to the Chairman, Directors, and staff concluded the business.

Gas Markets and Manufactures

Stock Market Report

(For Stock and Share Lists, see later pages)

After a brief respite the Stock Exchange last week was again dominated by international politics and a reactionary tendency spread to many sections. Home rails provided one of the few bright spots and most of these closed higher as a result of the more favourable outlook for the current year foreshadowed at the annual meetings. Gilt-edged stocks on the whole were only fractionally lower, while in the Industrial section, apart from a sharp rise in Associated Portland Cement on the increased dividend announcement, movements were mostly on the down grade. Towards the close, however, markets took a turn for the better and in the absence of any further developments from abroad a return to more active conditions is anticipated during the current week.

In contrast to many other sections the Gas Market received a good measure of support, prices were well maintained and several stocks speedily recovered from their recent *ex* div. markings. On the London Exchange the feature of the week was a sharp rise of 7 points to 162½ in British ordinary, to which stock reference was made last week. At the time of writing this price includes the full final dividend which a year ago was 4%. Another satisfactory improvement was that of Northampton 5%, which gained 5 points to 110½. Commercial ordinary commenced to improve again and rose 2 to 103½, while Shrewsbury ordinary registered a similar gain to 149½. The only set-back occurred in Imperial Continental with a drop of 5 to 172½. In the Supplementary List Ascot ordinary rose 7 points to 121½ and United Kingdom 4½% cumulative preference shares hardened 6d. to 21s. 6d.

Particulars will be found elsewhere in this issue of a sale by tender by the Mid-Southern District Utility Company of £100,000 4% consolidated preference stock at a minimum of £106%, yielding at this price £3 15s. 6d.%. The existing stock was marked up 2 points *ex* div. last week to 102-107.

Current Sales of Gas Products

The London Market for Tar Products.

March 2.

There is little of interest to report in the tar products market, prices being about as follows:

Pitch, 43s. 6d. per ton f.o.b.

Creosote, 5¼d. per gallon.

Refined tar, 3⅞d. per gallon in bulk at makers' works.

Pure toluole, 2s. 9d. to 2s. 10d.; pure benzole, 1s. 7d. to 1s. 8d.; 95/160 solvent naphtha, 1s. 8d. to 1s. 9d.; and 90/160 pyridine, about 4s. 9d.—all per gallon naked at makers' works.

Tar Products in the Provinces.

March 2.

The average prices of gas-works products during the week were: Gas-works tar, 24s. 3d. to 29s. 3d. Pitch—East Coast, 42s. 6d. to 45s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 42s. 6d. to 45s.* Toluole, naked, North, 2s. 2d. to 2s. 4d. Coal-tar crude naphtha, in bulk, North, 8d. to 8¼d. Solvent naphtha, naked, North, 1s. 6d. to 1s. 6½d. Heavy naphtha, North, 1s. to 1s. 1d. Creosote, *ex* works, in bulk, North, liquid and salty, 4⅜d. to 4½d.; low gravity, 4⅜d. to 4⅝d. Heavy oils, in bulk, North, 4⅞d. to 5d. Carbolic acid 60's, 2s. 4d. to 2s. 6d. Naphthalene, £19 to £21. Salts, 95s. to 100s., bags included. Anthracene "A" quality, 2½d. to 3d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Feb.* 29.

Market continues strong in all products with the exception of pitch. Values are therefore steady and, in some cases, show a slight appreciation.

Crude gas-works tar.—The actual value is 30s. to 31s. per ton *ex* works in bulk.

Pitch continues without interest at 35s. to 37s. 6d. per ton f.o.b. Glasgow for export, and 35s. per ton *ex* works in bulk for home trade.

Refined tar is being offered freely for prompt and forward delivery at 2¾d. to 3d. per gallon f.o.r. makers' works naked.

Creosote oil.—While no price alteration has taken place, demand is sufficient to look after production. B.E.S.A. Specification 5¼d. to 5⅝d. per gallon; low gravity, 5¼d. to 5½d. per gallon; and neutral oil, 5¼d. to 5½d. per gallon; all f.o.r. in bulk.

Cresylic acid.—There has been a continuance of the improved demand reported last week and to-day's prices are as follows: Pale, 97/99%, 1s. 5½d. to 1s. 6d. per gallon; dark, 97/99%, 1s. 4d. to 1s. 4½d. per gallon; pale, 99/100%, 1s. 8d. to 1s. 9d. per gallon; all *ex* works naked.

Crude naphtha is on short production and any supplies available command 5¼d. to 5⅝d. per gallon, according to quality and district.

Solvent naphtha.—90/160 grade is 1s. 4½d. to 1s. 5½d. per gallon, and 90/190 heavy naphtha is 1s. to 1s. 1d. per gallon.

Motor benzole is only available in small quantities at 1s. 3½d. to 1s. 4d. per gallon in bulk at makers' works.

Pyridines.—90/160 grade is now 5s. to 5s. 6d. per gallon, and 90/140 grade is 5s. 6d. to 6s. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole	0	9½	to	0	10	per gallon at works
Motor "	1	3	"	1	3½	" " "
90% "	1	4	"	1	4½	" " "
Pure "	1	7½	"	1	8	" " "

Contracts Advertised To-Day

Brass Fittings, &c.
Carlisle Gas Department. [p. 642.]

Coke.
Carlisle Gas Department. [p. 642.]

Coke Screening Plant.
Newton-in-Makerfield Gas Department. [p. 642.]

Compressor and Pressure Governors.
Halifax Gas Department. [p. 642.]

Condensers, &c.
Stockport Gas Department. [p. 642.]

Gas Oil.
Leeds Gas Department. [p. 642.]

Lamp Columns.
Stockport Gas Department. [p. 642.]

Lighting Goods.
Carlisle Gas Department. [p. 642.]

Meters.
Carlisle Gas Department. [p. 642.]

Oxide (New and Spent).
Carlisle Gas Department. [p. 642.]

Pipes (Various), Fittings, &c.
Carlisle Gas Department. [p. 642.]

Purifiers and Washing Plant.
Newton-in-Makerfield Gas Department. [p. 642.]

Stores (Sulphuric Acid, Bags, &c.).
Carlisle Gas Department. [p. 642.]

Trade Notes

Klönne Installations the World Over.

We learn from Dry Gasholders, Ltd., of 39, Victoria Street, S.W. 1, that Stacey Bros. Gas Construction Company, of Cincinnati, U.S.A., who hold the American rights for the Klönne type of waterless gasholder, have secured an important contract from the Ford Motor Company, of Detroit, for the construction of a 10 million cu.ft. capacity Klönne gasholder.

This holder will be 219 ft. 6 in. in diameter and 304 ft. 6 in. in height, and will represent the largest gasholder of this type in the world. Others of the larger Klönne holders are the 6,000,000 cu.ft. holder at Syracuse, U.S.A., and one of similar size erected at Dortmund, Germany.

Two Klönne holders erected at the new Cardiff Steel Works of Guest Keen Baldwins Iron and Steel Company, Ltd., by Horseley Bridge & Thomas Piggott, Ltd., were put into commission at the beginning of the year. One is of 3 million cu.ft. capacity for storage of blast furnace gas, and the other is of 1 million cu.ft. capacity for storage of coke oven gas. Horseley Bridge & Thomas Piggott, Ltd., have also recently completed two Klönne holders each of 100,000 cu.ft. capacity for Tipton and Erith.

Messrs. Ashmore Benson Pease & Co., Ltd., have completed four Klönne holders which are in satisfactory service—one at the York Gas-Works of 2 million cu.ft. capacity, two at the Pretoria Iron and Steelworks of 2 million and 1 million cu.ft. capacity, and one at the Cairns Gas-Works, Australia, of 150,000 cu.ft. capacity.

● *Apply* **SCIENTIFIC CONTROL** *to the best advantage by adopting*

THE WEST SYSTEMS

OF MODERN GAS AND COKE PRODUCTION

The West organization has co-operated with progressive Gas Undertakings in 24 countries in their schemes of works modernization, plant renewal, and extension.

- GLOVER-WEST VERTICAL RETORTS
- WESTVERTICAL CARBONIZING CHAMBERS
- BREEZE-FIRING PRODUCER EQUIPMENT
- WASTE-HEAT RECOVERY PLANTS
- THE WEST LIP-BUCKET CONVEYOR WITH AUTOMATIC LUBRICATION
- COKE GRADING AND PREPARATION UNITS

Contracts placed with West's Gas Improvement Company, Ltd., during the past year have included carbonizing plant installations for the Gas Undertakings of Buxton, Slough, *Salford, *Wellingborough, *West Bromwich, *Romford, and *Dudley in England; Kilsyth, *Montrose, and Kelso in Scotland; Newry in Ireland; *South Brisbane in Australia; Svendborg in Denmark; Mataro in Spain; and *Vannes and *Tarbes in France.

Repeat orders.

WEST'S GAS IMPROVEMENT COMPANY, LTD.

MANCHESTER: ALBION IRONWORKS, MILES PLATTING 'Phone: COLLYHURST 2961 : 'Grams: "STOKER, MANCHESTER"

LONDON: COLUMBIA HOUSE, ALDWYCH, W.C.2 'Phone: HOLBORN 4108 : 'Grams: "WESGASCO, ESTRAND, LONDON"

MEMBERS OF THE SOCIETY OF BRITISH GAS INDUSTRIES.

STOCK AND SHARE LIST

Official Quotations on the London Stock Exchange

Issue. £	Stock or Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Feb. 28.	Rise or Fall on Week.	Transactions, Lowest and Highest Prices During the Week.
1,551,868	Stk.	Sept. 9	7	7	Alliance & Dublin Ord. ...	145—155	...	152—154
374,000	,,	Dec. 16	4	4	Do. 4 p.c. Deb. ...	95—100	...	...
557,655	,,	Feb. 17	7	7	Barnet Ord. 7 p.c.	164—169*	...	...
300,000	1	Oct. 7	1 9/32	1 1/32	Bombay, Ltd.	1 5/32—1 9/32	...	...
179,305	Stk.	Aug. 12	9½	9½	Bournemouth sliding scale ...	222—232	...	...
590,407	,,	,,	7	7	Do. 7 p.c. max. ...	172—177	...	174
493,960	,,	,,	6	6	Do. 6 p.c. Pref. ...	150—155	...	...
50,000	,,	Dec. 16	3	3	Do. 3 p.c. Deb. ...	85—90	...	...
262,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	105—110	...	109—110
335,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	125—130	...	...
357,900	,,	Feb. 17	7½	7½	Brighton, &c., 6 p.c. Con. ...	170—175*	+3	173
649,955	,,	,,	6 3/4	6 3/4	Do. 5 p.c. Con. ...	153—158*	...	...
205,500	,,	,,	6	6	Do. 6 p.c. 'B' Pref.	144—149*	+1	146½
855,000	,,	Sept. 23	8	7	British Ord.	160—165	+7	162—162½
100,000	,,	Dec. 16	7	7	Do. 7 p.c. Pref.	153—158	...	...
350,000	,,	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	96—101	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	107—112	...	...
200,000	,,	,,	17/6§	3½	Do. 3½ p.c. Red. Deb. ...	98—100	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	1—3	...	...
100,000	10	6 Nov.'33	4½	4½	Do. 4½ p.c. Pref. ...	1—3	...	...
150,000	Stk.	Jan. 6	4½	4½	Do. 4½ p.c. Deb. ...	81—86	...	82—83¾
626,860	,,	Feb. 3	6	6	Cardiff Con. Ord.	131—136	...	...
98,936	1	Sept. 23	2 -	2 -	Colombo, Ltd., Ord.... ...	1 3/8—1 7/8	...	...
24,500	1	,,	1 4½	1 4½	Do. 7 p.c. Pref....	20/—22/-	...	...
609,204	1	Oct. 7	- 11·48	- 11·48	Colonial Gas Assn. Ltd. Ord.	19/6—21/6	...	20/6—20/9
296,053	1		1·3·30	1·3·30	Do. 8 p.c. Pref.	23/6—25/6	...	24/—24/6
1,775,005	Stk.	Feb. 3	5	5	Commercial Ord.	101—104	+2	101½—102½
620,000	,,	Dec. 2	3	3	Do. 3 p.c. Deb. ...	85—90	...	...
286,314	,,	Feb. 17	5	5	Do. 5 p.c. Deb. ...	119—124*	...	...
807,560	,,	,,	7	7	Croydon sliding scale ...	155—160*	...	159—160
644,590	,,	,,	5	5	Do. max. div.	113—118*	...	117—118
620,385	,,	Dec. 16	5	5	Do. 5 p.c. Deb.... ...	121—126	...	...
239,000	,,	Feb. 3	5	5	East Hull Ord. 5 p.c.... ...	107—110	...	...
181,625	,,	Feb. 17	6	6	East Surrey Ord. 5 p.c. ...	130—135*	...	...
175,609	,,	Dec. 16	5	5	Do. 5 p.c. Deb. ...	122—127	...	124
19,284,128	,,	Feb. 3	5½	5½	Gas Light & Coke 4 p.c. Ord	27/6—28/6a	...	27/10½—28/1½
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.... ...	88—91	...	90¾—92¼
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	107—110	...	109—109½
8,602,497	,,	Dec. 2	3	3	Do. 3 p.c. Con. Deb. ...	91—94	...	91½—92¼
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	117—120	...	119½—119¾
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	114—117	...	115
270,466	,,	Feb. 17	6	6	Harrogate New Cons. ...	130—135*	...	...
140,000	1	Sept. 23	1 7½	1 7½	Hongkong & China, Ltd. ...	1¼—1¾	...	...
213,200	Stk.	Aug. 12	6	6	Hornsey Con. 3½ p.c. ...	137—142	...	...
5,600,000	,,	Nov. 4	14	8	Imperial Continental Cap. ...	170—175	−5	171—177½
223,130	,,	Jan. 20	3½	3½	Do. 3½ p.c. Red. Debs.	92—97	...	...
285,242	,,	Feb. 17	8½	8½	Lea Bridge 5 p.c. Ord. ...	172—177*	...	...
165,736	,,	Aug. 26	10	8	Maidstone 5 p.c. Cap. ...	182—192	...	...
63,480	,,	Dec. 16	3	3	Do. 3 p.c. Deb. ...	80—85	...	...
75,000	,,	Dec. 2	†10	†10	Malta & Mediterranean ... Metropolitan (of Melbourne)	200—210	...	...
392,000	—	Oct. 1	5½	5½	5½ p.c. Red. Deb.	102—107	...	105½
231,978	Stk.	Feb. 17	5	5	M.S. Utility 'C' Cons. ...	110—115*	...	...
818,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	102—107*	+2	102—104¾
360,075	,,	Dec. 16	4	4	Do. 4 p.c. Deb. ...	103—108	...	...
148,955	,,	,,	5	5	Do. 5 p.c. Deb. ...	120—125	...	...
125,000	—	Jan. 2	3½	3½	Do. 3½ p.c. Rd. Rg. Bds.	96—99	...	...
675,000	Stk.	Nov. 18	†3	†3	Montevideo, Ltd.	60—65	...	61¾—62½
225,000	,,	Feb. 17	7½	7½	North Middlesex 6 p.c. Con.	169—174*	...	...
396,160	,,	Feb. 3	5	5	Northampton 5 p.c. max. ...	108—113	+5	...
300,000	,,	Nov. 4	17	9	Oriental, Ltd....	167—172	...	...
416,617	,,	Dec. 16	8	8	Plymouth & Stonehouse 5 p.c.	162—167	...	...
504,416	,,	Feb. 3	8½	8½	Portsm'th Con. Stk. 4 p.c. Std.	170—175	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	108—113	...	...
114,000	,,	Feb. 3	5	5	Preston 5 p.c. Pref.	110—115	...	...
321,961	1	Sept. 23	...	1 -	Severn Val. Gas Cor. Ld. Ord.	22/—23/-	...	22/9
319,510	1	,,	...	- 10½	,, ,, 4½ p.c. Cum. Pref.	21/9—22/9	...	...
133,201	Stk.	Feb. 17	8½	5	Shrewsbury 5 p.c. Ord. ...	147—152*	+2	...
90,000	10	May 27	†3	†3½	South African...	3—4	...	...
1,061,779	1	Sept. 23	1 2	1 2½	South East'n Gas Cn. Ld. Ord.	27/6—28/6	...	27/9
845,016	1	,,	- 10½	- 10½	Do. 4½ p.c. Red. Cum. Pref.	22/3—23/3	...	22/3—23/3
200,000	1	,,	...	4	Do. 4 p.c. Cum. Pref. ...	21/—22/-	...	...
450,000	Stk.	Feb. 17	4	4	Do. 4 p.c. Red. Deb. ...	101—104*	...	...
6,709,895	,,	Feb. 3	5	6½	South Met. Ord.	126—129	...	125½—127¾
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf....	147—152	...	150—151½
850,000	,,	,,	4	4	Do. 4 p.c. Irred. Pf....	103—107	...	...
1,895,445	,,	Dec. 16	3	3	Do. 3 p.c. Deb. ...	88—91	...	90
1,000,000	,,	Jan. 6	5	5	Do. 5 p.c. Red. Deb.	114—117	...	116—116¾
1,543,795	,,	Feb. 3	6	6	South Suburban Ord. 5 p.c....	130—135	...	130—132½
512,825	,,	,,	5	5	Do. 5 p.c. Pref....	120—125	...	...
500,000	,,	,,	4	4	Do. 4 p.c. Pref....	102—107	...	...
888,587	,,	Dec. 16	5	5	Do. 5 p.c. Deb....	123—128	...	...
250,000	,,	,,	4	4	Do. 4 p.c. Deb....	103—108	...	...
415,907	,,	Dec. 2	...	4	S. Western Gas & Water Ord.	23/—24/-	...	...
160,523	,,	Oct. 21	...	...	Do. 4½% Red. Cum. Pref.	22/—23/-	...	...
110,000	,,	Dec. 16	4	4	Do. 4½% Red. Deb. ...	98—103	...	...
647,740	,,	Feb. 3	5	5	Southampt'n Ord. 5 p.c. max.	113—118	...	116½
121,275	,,	Dec. 16	4	4	Do. 4 p.c. Deb.	98—103	...	...
350,000	,,	Feb. 3	5½	5½	Swansea 5½ p.c. Red. Pref. ...	111—116	...	...
106,000	,,	Dec. 16	6½	6½	Do. 6½ p.c. Red. Deb. ...	96—101	...	...
94,000	,,	...	...	...	Do. 3½ p.c. Red. Deb. ...	96—101	...	100½
1,076,490	,,	Feb. 17	6¾	6¾	Tottenham and District Ord.	149—154*	...	152—153¾
409,835	,,	,,	5⅝	5⅝	Do. 5½ p.c. Pref....	128—133*	...	131½—132½
62,235	,,	,,	5	5	Do. 5 p.c. Pref. ...	118—123*	...	...
371,850	,,	Dec. 2	4	4	Do. 4 p.c. Deb. ...	103—108	...	...
369,774	,,	Feb. 3	7	7	Uxbridge, &c., 5 p.c. ...	150—155	...	...
106,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	115—120	...	...
1,340,521	,,	Feb. 3	7	7	Wandsworth Consolidated ...	158—163	...	160½
1,371,373	,,	,,	5	5	Do. 5 p.c. Pref. ...	122—127	...	125—126½
1,317,964	,,	Dec. 16	5	5	Do. 5 p.c. Deb. ...	123—128	...	...
338,300	,,	,,	4	4	Do. 4 p.c. Deb. ...	102—107	...	...
499,735	,,	Feb. 17	6¾	7¼	Watford and St. Albans Ord.	155—160*	...	...
200,000	,,	,,	5	5	Do. 5 p.c. Pref. ...	118—123*	...	...
200,000	,,	,,	5⅓	5⅓	Do. 5½ p.c. Pref. ...	133—138*	...	...
200,000	,,	Dec. 2	4	4	Do. 4 p.c. Red. Deb.	98—103	...	...
100,000	,,	,,	...	3½	Do. 3½ p.c. Red. Deb.	96—101	...	...
158,400	,,	Aug. 12	6b	5	Winchester W. & G. 5 p.c. Con.	114—119	...	...

a.—The quotation is per £1 of Stock. b.—Paid £3, including 10s. on account of back dividends. * Ex div.
† Paid free of income-tax. ‡ For year. § Actual for three months.

Stock and Share List continued overleaf.

Service

The value of your Sales and Service men is gauged by the knowledge they possess of matters pertaining to the Industry they serve. The more knowledge they possess the greater the assistance they can be towards building up an efficient and successful organization.

At little cost, the "GAS SALESMAN" (published monthly) offers a ready means to this end. As the only separate publication devoted exclusively to the sales and service side of the Industry, it has an individuality of its own and keeps its readers abreast of the times.

Do all your sales and service men regularly receive a copy of each month's issue?

Specimen copies will gladly be supplied on request.

The annual subscription is 6s.

All communications to Walter King, Limited, The "GAS SALESMAN" Offices, 11, Bolt Court, Fleet Street, London, E.C. 4.

STOCK AND SHARE LIST—Cont.

Stocks Officially Quoted on Provincial Exchanges

Issue. £	Stock or Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. Feb. 28.	Rise or Fall on Week.	Transactions, Lowest and Highest During the Week.
BRISTOL EXCHANGE.								
347,756	Stk.	Feb. 3	5	6	Bath Cons.	124—126	...	...
1,667,250	,,	Feb. 17	5	5	Bristol, 5 p.c. max.	119—121*	...	...
120,420	,,	Dec. 16	4	4	Do. 1st 4 p.c. Deb. ...	102—104	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	102—104	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	125—128	...	...
274,000	,,	Feb. 17	5	5	Newport (Mon.) 5 p.c. max. ...	111—116*	...	...
13,200	12	Aug. 26	8½	7	Pontyp'l Gas & W. 10 p.c. 'A.'	14½—15½	...	...
13,600	10	,,	6	5	Do. 7 p.c. 'B.'	11½—12½	...	...
40,000	10	,,	6	5	Do. 7 p.c. 'C.'	11½—12½	...	...
140,778	Stk.	Feb. 17	5	5	Weston-super-Mare Cons. ...	113—115*	...	...
64,338	,,	Dec. 16	4	4	Do. 4 p.c. Deb.	98—100	...	...
33,340	,,	,,	7½	7½	Do. 7½ p.c. Deb.	165—169	...	...
LIVERPOOL EXCHANGE.								
157,150	Stk.	Feb 3	5	6½	Chester 5 p.c. Ord.	107½—112½	...	...
92,500	,,	Dec. 16	4	4	Do. 4 p.c. Pref.	100—105	...	...
32,540	,,	,,	3½	3½	Do. 3½ p.c. Deb. ...	91—96	...	...
41,890	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	100—105	...	...
2,167,410	,,	Feb. 17	6	6	Liverpool 5 p.c. Ord. ...	133—135	−1	...
245,500	,,	Dec. 16	5	5	Do. 5 p.c. Red. Pref. ...	103—108	...	...
306,083	,,	Jan. 6	4	4	Do. 4 p.c. Deb. ...	105—107	...	...
106,280	,,	Feb. 3	10	10	Preston 'A' 10 p.c. ...	202—212	...	...
188,219	,,	,,	7	7	Do. 'B' 7 p.c.	140—150	...	...
NEWCASTLE EXCHANGE.								
122,577	Stk.	Aug. 12	8	8	Blyth 5 p.c. Ord.	151—153	...	...
732,000	,,	Feb. 3	5	5	Hartlepool G. & W. Co. & New	118—120	...	...
2,061,315	,,	Feb. 3	5	5½	Newcastle & Gateshead Con.	24 9—25 3*a*	−/1½	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	106½—107½	...	...
776,706	,,	Dec. 16	3½	3½	Do. 3½ p.c. Deb. ...	100½—101½	...	...
277,285	,,	Oct. 21	5	5	Do. 5 p.c. Deb. '43...	105—106	...	...
209,820	,,	Aug. 12	8½	8½	South Shields Con.	173—175	...	...
299,542	,,	Feb. 3	6	6	Sunderland 6 p.c. max. ...	129—131	...	...
NOTTINGHAM EXCHANGE.								
542,270	Stk.	Feb. 17	7	10	Derby Con.	172—182*	...	...
55,000	,,	Dec. 16	4	4	Do. 4 p.c. Deb.	100—105	...	...
84,750	,,	Feb. 17	5	12	Long Eaton 'A' Ord. ...	150—160*	...	...
50,000	,,	,,	4	10	Do. 'B' Ord. ...	130—140*	...	...
20,000	10	June 7	5	5	Do. 5 p.c. Pref. ...	10—12	...	...
80,000	Stk.	,,	5	5	Do. 5 p.c. Deb. ...	117—122	...	...
SHEFFIELD EXCHANGE.								
10,000	Stk.	Feb. 17	10	10	Great Grimsby 'A' Ord. ...	220—230	...	...
6,500	,,	,,	10	10	Do. 'B' Ord. ...	220—230	...	...
79,000	,,	,,	10	10	Do. 'C' Ord. ...	205—215	...	...
1,806,339	,,	Feb. 17	6	6	Sheffield Cons.	142—145	...	...
95,000	,,	Dec. 16	4	4	Do. 4 p.c. Deb.... ...	100½—102½	...	...

a The quotation is per £1 of Stock.

Supplementary List of Stocks and Shares not Officially Quoted

202,152	Stk.	...	...	...	Ascot Ord.	119—124	+7	...
128,182	,,	...	...	...	Do. 5 p.c. Pref. ...	117—122	...	...
90,000	1	Nov. 4	5	5	Assd. Gas and Water Ord. ...	21/—23/-	...	22/9
90,000	1	,,	4½	4½	Do. 4½ p.c. Cum. Pref. ...	22/—23/-	...	...
17,000	Stk	Feb. 17	8	8	Bognor Orig. Ord. 'A' ...	162—172*	...	...
62,210	,,	,,	8	8	Do. New Addl. 'A' ...	162—172*	...	167
87,160	,,	,,	7	7	Do. New 7 p.c. max. ...	140—145*	...	...
37,440	,,	Feb. 3	10	10	Cam.Univ. & Town 10 p.c.max.	210—220	...	...
125,970	,,	,,	7	7	Do. 7 p.c. max.	158—163	...	...
39,025	,,	,,	5	5	Do. 5 p.c. max.	108—113	...	...
65,000	,,	Aug. 12	8½	7½	Eastbourne 'A' 5 p.c. ...	153—158	...	...
198,000	,,	,,	7	6	Do. 'B' 3½ p.c.	135—140	...	...
112,312	,,	,,	5	5	Do. 5 p.c. Pref.	120—125	...	...
130,000	,,	Dec. 16	5	5	Do. 5 p.c. Deb.	122—127	...	...
250,000	1	Nov. 18	...	4	Gas Consolidation Ord. ...	20 6—22 6	...	...
250,000	1	,,	...	4	Do. 4 p.c. Red. Cum. Pref.	19 6—20 6	...	19/10½
117,251	Stk.	Sept. 23	8 1/10	8 1/10	Gosport District Cons. ...	177—182	...	...
73,350	,,	,,	5	5	Do. 5 p.c. Pref.	113—118	...	...
24,000	30	Feb. 3	8½	8½	Great Yarmouth 8½ p.c. max.	52—57	...	...
59,400	30	,,	7½	7½	Do. 7½ p.c. max.... ...	42—45	...	...
51,160	Stk.	Dec. 2	5½	5½	Do. 5½ p.c. Deb.... ...	123—128	...	...
152,600	,,	Aug. 26	8	8	Guildford Cons.	175—180	...	...
54,055	,,	,,	5	5	Do. 5 p.c. Pref.	116—121	...	...
68,250	,,	Dec. 16	5	5	Do. 5 p.c. Deb.	120—125	...	...
156,600	,,	Feb. 3	7½	7½	Hampton Court Cons. ...	167—177	...	...
81,660	10	Feb 4,'35	5	9	Leatherhead Ord.	16—17	...	...
107,960	10	Sept. 23	5	4	Mid Kent Ord.	9½—10½	...	9⅛—9⅜
230,940	Stk.	Feb. 17	10	10	Oxford & District Ord. ...	212—222*	...	224¾
47,112	,,	,,	5	5	Do. 5 p.c. Pref.	115—120*	...	...
50,000	,,	,,	6	6	Do. 6 p.c. Red. Pref. ...	113—118*	...	...
126,193	,,	Nov. 18	7½	7½	Peterborough Ord.	160—170	...	...
64,990	,,	Sept. 9	7½	6½	Redditch Ord.	116—121	...	...
166,850	,,	Feb. 17	7	9	Romford Ord.	167—172*	...	...
60,000	,,	,,	4	4	Do. 4 p.c. Pref.	97—100*	...	...
44,000	,,	Sept. 23	5	5	Do. 5 p.c. Deb.	122—127	...	...
10,950	,,	Aug. 26	8	8	Ryde Ord.	168—173	...	...
136,191	,,	Feb. 3	5	7	Scarborough Ord.	128—138	...	...
27,825	,,	Feb. 3	8	8	Shanklin & Ventnor Cons. ...	152—162	...	...
40,643	,,	Sept. 23	7	7	Slough Ord.	150—155	...	152—154
221,000	,,	Dec. 16	5	5	Do. 5 p.c. Deb.	116—121	...	...
28,872	1	Nov. 4	5½	5½	S. Midland Gas Cpn.Ltd. Ord.	20/—22/-	...	...
28,866	1	Sept. 9	4½	4½	Do. 4½ p.c. Red. Cum Pref.	20/—22/-	...	...
24,930	Stk.	Feb. 17	7	7	Southgate & Dist. 7 p.c. max.	148—153*	...	...
162,500	,,	,,	5	5	Do. 5 p.c. Pref.	115—120*	...	...
117,228	,,	Aug. 12	6	5	Swindon Cons.	113—118	...	...
60,425	,,	Dec. 16	5	5	Do. 5 p.c. Deb.	122—127	...	...
50,000	1	...	...	...	Utd. Kingdom Gas Cpn. Ord.	1 1/16—1 1/8	...	21/6
760,910	1	Nov. 18	...	2½	Do. 4½ p.c. Prefd. Ord....	20/—21/-	...	20/10½—21/-
110,910	1	,,	...	2½	Do. 4½ p.c. Cum. Pref. ...	21/—22/-	+/6	21/1½—21/3
900,000	Stk.	,,	...	...	Do. 3½ p.c. Red. Deb. ...	98—101	...	...
130,000	,,	Feb. 3	5	8	Wakefield Ord.	137—142	...	...
81,650	,,	,,	5	5	Do. 5 p.c. max.	101—106	...	...
82,000	,,	Feb. 3	6	6	Weymouth Ord.	106—111	...	...
370,000	,,	Feb. 3	4	6	York Cons.	107—112	...	111½
90,000	,,	Dec. 16	5	5	Do. 5 p.c. Red. Deb. ...	103—108	...	...
133,640	,,	Feb. 3	6½	6½	Yorktown (Cam.) 5 p.c. Cons.	118—123	...	...
120,000	,,	,,	5	5	Do. 5 p.c. Pref.	115—120	...	...
35,000	,,	Dec. 16	5½	5½	Do. 5½ p.c. Deb.... ...	130—135	...	...

"Modern Gas Fitting"

PART VI.

of

Gas Fitting Pamphlets

Another of the Popular Series of reprints, in booklet form, of the articles on "Modern Gas Fitting," contributed monthly to the

"GAS SALESMAN"

by

R. N. LeFevre, M.Inst.Gas E.

Officer in Charge of Training, The Gas Light and Coke Company, Assistant Head of Department of Gas Engineering and Supply, Westminster Technical Institute.

POST FREE PRICES:

Single Copies, 6d.; 5/6 a dozen. Quantities of 100 for 35/-, plus carriage

WALTER KING, LTD.,

11, Bolt Court, Fleet Street, London, E.C. 4

Parts I to V have been reprinted, and can also be supplied.